STUDY ON LOCAL AND EUROPEAN BEST GREEN PRACTICES IN THE FIELD OF WASTE MANAGEMENT

EU ENVIRONMENTAL POLICY AND MEASURES FOR IMPLEMENTATION OF BEST GREEN PRACTICES

COMPARATIVE LEGAL ASSESSMENT OF THE LEGISLATION REGARDING WASTE MANAGEMENT IN THE BG-SR CBC REGION

SUCCESSFUL MODELS AND BEST PRACTICES IN WASTE MANAGEMENT AND ESTABLISHMENT OF EU LEGISLATION IN THE BG-RS CBC REGION

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Summary

The aim of the current study is to give a comprehensive overview of current situation, methodologies, strategies and implemented policies in the field of two hot topics: disaster prevention and environmental protection.

In the scope of disaster prevention, the 1st part of the study covers the European Union Civil Protection Mechanism (UCPM), its structure, approaches and measures, innovations, equipment and working applicable models. Through the UCPM, the European Commission plays a key role in coordinating the response to disasters in Europe and beyond. Since its entrance into force, the EU Civil Protection Mechanism has responded to over 300 requests for assistance inside and outside the EU.

The 2nd part of the study gives detailed overview of some important aspects of environmental protection strategies and policies. These include presentation of green practices, effective approaches and green measures for maintenance of sustainable ecosystems, quality of air, water and soil on EU level and on national level in five countries (Denmark, Portugal, Estonia, Japan and New Zealand). Urban areas are the source of many of today's environmental challenges — not surprisingly, since two out of three Europeans live in towns and cities. Local governments and authorities can provide the commitment and innovation needed to tackle and resolve many of these problems. The current environmental policies, laws and recent amendments of local legislation and their objectives and targets are presented. EU citizens benefit from some of the highest environmental standards in the world. The EU and national governments have set clear objectives to guide European environment policy until 2020 and a vision beyond that, of where to be by 2050, with the support of dedicated research programmes, legislation and funding. EU environmental policies and legislation protect natural habitats, keep air and water clean, ensure proper waste disposal, improve knowledge about toxic chemicals and help businesses move toward a sustainable economy. Waste management is another important part of environmental protection. As a result of economic development and population growth, over the last few decades, the world is faced with a global increase not only in the amount of waste, but also in the diversity of its quality. Improperly managed waste deteriorates the living environment as well as public health, sometimes causing serious health problems. Sustainable development requires properly dealing with waste issues. Apart of that, more and more attention is being paid to the re-use of raw materials and recycling waste products. The study presents waste management strategies and current policies in Denmark, Portugal, Estonia and New Zealand, environmental laws, recent amendment, objectives and targets. It also presents the local policies in waste management in the BG-RS CBC region.

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I. The Union Civil Protection Mechanism: effective equipment, innovations, approaches and measures. Working and applicable models

1. UCPM

Disasters know no borders and can hit one or several countries simultaneously without warning. Having a well-coordinated joint response means that when national authorities are overwhelmed, they have one point of contact, rather than multiple to deal with. A joint approach further helps to pool expertise and capacities of first responders, avoids duplication of relief efforts and ensures that assistance meets the needs of those affected.

1.1. Background - The EU Civil Protection Mechanism from 2001 to 2013 and the Civil Protection Financial Instrument

The Union Civil Protection Mechanism (UCPM) was set up in 2001 to improve the EU response to natural and man-made disasters inside and outside Europe. It is governed by Decision No 1313/2013/EU of the European Parliament and of the Council. The overall objective of UCPM is to strengthen cooperation between EU member states, 6 participating states (Iceland, Norway, Serbia, North Macedonia, Montenegro, and Turkey) and the UK during the transition period, in the field of civil protection, with a view to improve prevention, preparedness and response to disasters. The mechanism intervenes in different kind of emergencies, such as wildfires, floods, earthquakes, hurricanes and industrial accidents. Since its inception the EU Civil Protection Mechanism has responded to over 330 requests for assistance inside and outside the EU, including: Hurricane Katrina (United States, 2005), earthquakes (Italy, 2009; Haiti, 2010; Turkey, 2011; Japan, 2011;Nepal, 2015), tsunamis (Japan, 2011), the need for evacuation assistance (Libya, 2011),ammunition explosions, (Democratic Republic of the Congo, 2012), typhoons, flooding, forest fires and tropical storms (Pakistan, 2011;El Salvador, 2011; the Philippines, 2011,2013; Bosnia and Herzegovina, 2013,2014; Serbia, 2014), extreme weather (Slovenia, 2014),the Ebola outbreak (2014), the conflict in Ukraine (2014) and the refugee crisis in Europe (2015).

The Mechanism also intervenes in marine pollution emergencies: the Centre can quickly mobilise oil recovery capacity and expertise from the Participating States and European Maritime Safety Agency (EMSA). When the scale of an emergency overwhelms the response capabilities of a country, it can request assistance via the Mechanism.

The Mechanism is based on a series of elements and actions, including:

- compiling an inventory of assistance and intervention teams available in EU countries;
- establishing a training programme for members of such teams;
- launching workshops, seminars and pilot projects on the main aspects of interventions; setting up assessment and coordination teams;
- establishing a Monitoring and Information Centre (MIC) and a common communication and information system;
- establishing a Common Emergency Communication and Information System (CECIS) between the MIC and EU countries’ contact points;
- helping to develop detection and early warning systems;
- facilitating access to equipment and transport by providing information on the resources available from EU countries and identifying resources available from other sources;
- making additional transport resources available.

In accordance with the principle of subsidiarity, CPM goal is to provide added-value to European civil protection assistance by making support available upon request of the affected country. This may

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arise if the affected country's disaster preparedness is not sufficient to provide an adequate response in terms of available resources. By pooling the civil protection capabilities of the participating states, the Community Mechanism can ensure even better protection primarily of people, but also of the natural and cultural environment as well as property. The Mechanism also:

- develops detection and rapid alert systems for catastrophes that may hit Member States, with a view to enabling rapid response by other countries;
- provides support for accessing equipment and transport resources;
- supports consular assistance to EU citizens in major emergencies in third countries if requested by the consular authorities of the Member States;
- integrates transport provided by Member States by financing additional transport resources necessary for ensuring a rapid response to major emergencies;
- develops civil protection modules, namely specialised operational teams comprising personnel, transport and equipment provided by Member States and “packaged” in accordance with the task in question, in line with specific criteria.

Since its creation, the Mechanism has provided civil protection assistance in a variety of natural and manmade disasters, it has facilitate the cooperation in disaster response, preparedness and prevention among European states, coordinating response at a European level in order to avoid duplication of relief efforts and to ensure that assistance meets the real needs of the affected regions.

The UCPM main supporting organisations are:

- **The MIC**

  MIC is the operational heart of the Mechanism, is an operative unit offering 24/7 response for facilitating the mobilisation of civil protection resources from EU countries in the event of an emergency. The centre gives countries access to a community civil protection platform: the CECIS for communication and exchange of information between the MIC and National Contact Points in Member States.

- **CECIS**

  The CECIS is an IT system run directly by the Mic in Brussels for immediate effective dialogue between 24/7 operations centres in Member States. The requests made by the affected country are matched by the system to offers of assistance from countries that decide to intervene. CECIS provides all the Member States with information and updates on the emergency until it is resolved. The Mechanism was originally located in the DG Environment’s Civil Protection Unit, but with the Lisbon. Treaty its coordinating role passed to EU Humanitarian Aid Department (ECHO). After 10 years of implementation, increasing activations and a successful string of and emergency responses within and outside the EU, a necessity for better cooperation and levels of protection in domestic, European and international levels emerged. A Decision for a new Mechanism for the period 2014-2020 was adopted in December 2013 and from January 1st 2014, a new, improved UCPM is in force. *The Article 196 of the Treaty on the Functioning of the European Union* constitutes the primary legal basis for the Union Mechanism. Concerning the **Civil Protection Financial Instrument**, it was established with the Council Decision 2007/162/EC, and through it financial assistance was given to improve the effectiveness of response to major emergencies and to enhance preventive and preparedness measures for all kinds of emergencies. A total of EUR 189.8 million was committed for the implementation of the Civil Protection Financial Instrument for the period 2007-2013. Whilst the majority of the Mechanism actions were financed through the Civil Protection Financial Instrument, some actions were financed through additional funds granted by the European Parliament and the Council as well as other EU Instruments. National civil protection authorities also contributed by:
    - Providing part of the co-financing required by the Financial Instrument;
    - Having civil protection staff participating in the Mechanism actions; and,

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- Providing in-kind resources (i.e. civil protection assets and equipment).

The budget for the implementation of the UCPM for 2014-2020 is EUR 368.4 million of which EUR 223.7 million shall be used for prevention, preparedness and response actions inside the EU and EUR 144.6 million for actions outside the EU. These amounts are complemented by contributions from non-EU countries that participate in the EU Civil Protection Mechanism.

1.2. The new UCPM

A rising trend in natural and man-made disasters over the past decade has demonstrated that coherent, efficient and effective policies on disaster management are needed now more than ever. The EU Civil Protection legislation was revised at the end of 2013 to better respond to the natural and manmade disasters in a swift, pre-planned and effective manner and thus to increase the security of EU citizens and disaster victims worldwide. The revised EU Civil Protection legislation (Decision of the European Parliament and of the Council on a UCPM – 1313/2013/EU and the Commission Implementing Decision No 2014/762/EU) builds on an established system that has proven to work well. The primary responsibility for disaster management remains with the Member States. The new Mechanism places a much greater emphasis on disaster prevention, risk management, and disaster preparedness, including the organisation of trainings, simulation exercises and the exchange of experts, but also developing new elements, such as a voluntary pool of pre-committed response capacities by the Member States. The revised legislation contains new actions to be undertaken in relation to disaster risk reduction and the scope of building a culture of prevention, promoting better preparedness and planning, closer cooperation on disaster prevention and more coordinated and faster response. For these reasons the legislative basis includes measures that will help to be better prepared for any upcoming disasters and that will ensure closer cooperation among the participating States.

The main focus of the Decision 1313/2013/EU is related to:

- Increasing the culture of prevention and preparedness
- Replacing ad-hoc response with a pre-planned approach
- Supporting the Member States on their capacity development

In this framework, Member States have agreed to regularly share a summary of their risk assessments and best practices, as well as to help each other identify gaps and to refine their risk management planning, in order to reduce disaster risk and to further strengthen the joint collaboration in building resilience to disasters. A better understanding of risk is the basis for more effective disaster management and the Member States favour a coherent and effective approach also through the sharing of non-sensitive information (information whose disclosure would be contrary to the essential interests of the security of the Member States), and the sharing of good practice. The reform, as well as underlining the importance of prevention, preparedness and response to natural and/or man-made disasters - art. 196 of the **Treaty on the Functioning of the European Union (TFEU)** - focuses also on the involvement of regional authorities and of the entire National Service of Civil Protection, in order to ensure interventions and assistance in case of need. The new mechanism has an operationally enhanced profile: the involvement of the regions meets the need for interoperability and preparation of those involved - with the addition of the need for a civil protection across sectors, as in the case of cooperation in the field of marine pollution. This commitment is carried out in full respect of the solidarity clause foreseen by the Lisbon Treaty, according to which *"The Union and its Member States shall act jointly in a spirit of solidarity if a Member State is the object of a terrorist attack or the victim of a natural or man-made disaster."* In terms of civil protection, there will be more training available for personnel outside their home countries, more response exercises in areas such as search and rescue and field hospitals, more exchanges between experts and closer cooperation with neighbouring countries. A new Emergency Response Coordination Centre (ERCC) was inaugurated in May 2013 **(Figure 1)**. It was established on the basis of over 10 years of experience of coordinating European disaster response. In 2001, its predecessor, the MIC was created as the main operational tool of the EU CPM. It reinforces and transforms the MIC into an ERCC and the MIC (Monitoring

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Information Centre) ensuring 24/7 operational capacity and serving the member states and the European Commission in facilitating the coordination of civil protection assistance interventions. Thus, ERCC is the “heart” of the UCPM as it replaces and upgrades the functions of the previous MIC. Beyond that it plays a key role as a coordination of the response of the participating countries in case of a crisis, thus planning a better joint European assistance in advance.

Figure 1. ERCC planning, monitoring and coordinated response to risks and disasters; Source: Publications Office of the European Union, 2015, Civil protection at a glance

It also monitors the situation related to risks and emergencies around the world and provides an information and coordination hub during emergencies **(Figure 2)**

Figure 2. Emergency Response Coordination Centre

A voluntary pool of Member States response capacities and experts on stand-by is going to be established, with partial EU funding support, to enable more effective pre-planning, immediate deployment, and coordinated interventions. The proposal also includes for the first time a common effort of Member States to assess and address gaps in response capacities with the help of EU seed financing of up to 20 per cent of necessary investment. The types of disasters covered by the EU CP Mechanism are:

- ***Natural disasters*** - Floods, earthquakes, forest fires, cyclones, typhoons
- ***Manmade disasters*** - Environmental disasters (oil spills, Deepwater Horizon, HU alkali sludge accident 2010)
- ***Complex emergencies*** - Georgia 2008, Syria, Ukraine 2014
- ***Health emergencies*** - Ukraine H1N1 / Ebola crisis 2014, H1N1 crisis (medical support Bulgaria, Ukraine)

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- ***Assistance to consular support*** - Terrorist attacks (medical evacuation Mumbai - India) - Evacuation of EU citizens from Libya and TCN from Tunisia/Egypt; Yemen)

The new legislation reinforces the intervention of the Mechanism in the three phases of disaster management cycle:

PREVENTION

Prevention means supporting the Member States in preventing risks or reducing harm to people, the environment or property resulting from emergencies. The new Mechanism in going to improve knowledge methodologies and access to data. In this framework risk assessment guidelines, risk management plans, peer reviews are going to be realised and continuously updated. Other than this the integration of Disaster Risk Reduction (DRR) into sectorial policies is one of the most important priorities. In relation to the Climate Change adaptation, the Mechanism also

- Promotes Member States' risk assessments and mapping through the sharing of good practice;
- Establishes and updates a cross-sectoral overview and map of the disaster risks faced by the Union taking into account the likely impacts of climate change
- Encourage exchange of good practices on preparing national civil protection systems to cope with the impacts of climate change.

Concerning Prevention, the main Commission's actions are

- Promoting Member States' risk assessments and mapping through the sharing of good practice;
- Establishing and update a cross-sectoral overview and map of the disaster risks faced by the Union taking into account the likely impacts of climate change;
- Encouraging exchange of good practices on preparing national civil protection systems.

The main Member States’ actions are described below **(Figure 3)**

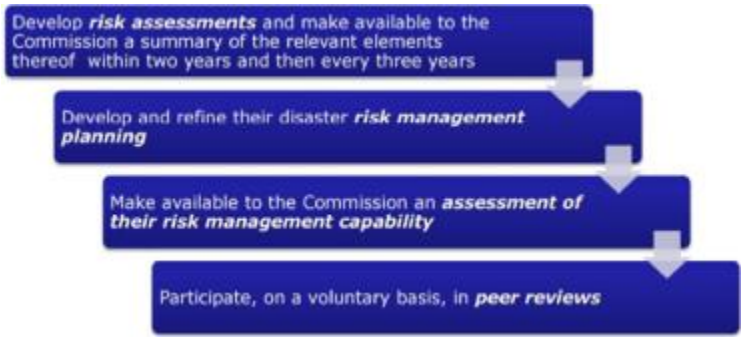

Figure 3. Consecutive actions of Member States in Prevention phase of disaster management cycle

PREPAREDNESS

Preparedness means increasing competences for civil protection assistance interventions and responses inside as well as outside Europe. It means also providing countries with the opportunity to train their civil protection teams, increasing their ability and effectiveness in responding to disasters. For these reasons the Mechanism organises training programmes, exercises during simulated emergencies, exchange of expert's programmes, cooperation projects. Preparedness means also early warning tools and capability assessment and certification.

The new Mechanism is planning some ongoing key developments such as:

- the development of civil protection response modules;
- the identification of experts and teams for EU missions;
- the development of the training exercises, exchange of experts, also through the lessons learned;

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- the facilitation through the Host Nation Support (how to receive assistance); - the use of geo-spatial information/maps derived from satellite remote sensing (Copernicus emergency management service), both in preparedness and in response.

RESPONSE

Response means facilitating the cooperation in civil protection assistance interventions in the event of major disasters inside and outside the EU. Assistance may include search and rescue teams, medical teams, shelter, water purification units and other relief specialised experts /items requested, all hazard approaches, including the biological one. Finally, the new international elements of the Civil Protection Mechanism are related to **(Figure 4)**:

Figure 4. New international elements of the Civil Protection Mechanism

The Mechanism provides emergency communications and monitoring tools, through a system of web-based alert and notification applications enabling real time exchange of information between participating states and the ERCC. The Mechanism has developed the disaster forecasting and disaster management tools: a proper planning, monitoring, and early warning can mitigate damages, sometimes preventing them from turning into humanitarian catastrophes. So, the Mechanism has a near real-time alert systems with the aim of improving its rapid analytical capacity. The Mechanism also intervenes in marine pollution emergencies: The Centre can quickly mobilise oil recovery capacity and expertise from the Participating States and European Maritime Safety Agency (EMSA). When the scale of an emergency overwhelms the response capabilities of a country, it can request assistance via the Mechanism.

1.3. Recent changes

The forest fires in 2017 and 2018 revealed the limits of the voluntary approach when it comes to responding to complex and recurrent events. In November 2017, the Commission tabled a proposal amending the current legislation aiming to achieve three objectives:

- In order to be able to protect its citizens more effectively, not least in the event of a terrorist attack or a chemical, biological, radiological or nuclear incident, the EU has decided to strengthen its response capacity. That has been done by creating a common European reserve of response capacities, “rescEU” and enhance the existing voluntary pool, which will be known as European Civil Protection Pool (ECPP). This will be used as a last resort, when national voluntary capabilities are spent. It will consist of trained medical staff, field hospitals, firefighting planes, water pumps and urban search and rescue (USAR) teams. The rescEU capacities will be hosted by the Member States and co-financed by the EU. The upgraded UCPM also aims to improve risk prevention and preparedness, helping Member States to enhance their disaster risk management. An EU civil protection knowledge network will boost cooperation on training, research and innovation and the exchange of best practice.
- Strengthening the prevention and preparedness action as part of the risk management cycle and improving coherence with other EU policies dealing with disaster risk prevention and management.

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- Simplifying the administrative procedures to ensure rapid access to assistance.

On 31 May 2018, the European Parliament adopted amendments to the Commission proposal related to:

- Flexibility of rescEU capacities, their additional role vis-a-vis the Members States capacities under the Pool, and the share of strategic and operational responsibilities for the command and control
- UCPM field of action to be extended to terrorist attacks and chemical, biological, radiological and nuclear threats
- Regional and local dimension of the issue
- Importance of Member States prevention and preparedness plans, especially in relation with investments and post-disaster reconstruction
- Relation with other EU funds, such as the Solidarity Fund
- Union financial support for national assets that are not pre-committed to the ECPP
- Member States risk assessments that should also take into account the specific risks to wildlife and animal welfare.

The Parliament also sought to ensure separate funding and budgetary allocations for the revised Union Mechanism. The inter-institutional negotiations started on 4th September 2018 and provisional agreement between the Council Presidency and the European Parliament representatives was reached on 12th December. In February 2019, the Members of the European Parliament approved the agreement by 620 votes to 22 and 35 abstentions. According to the adopted text that amends the Commission proposal:

- Member States retain primary responsibility for disaster prevention and response on their territory. The assistance provided by a Member State through the ECPP is complementary to existing national capacities. The Pool consists of voluntarily pre-committed response capacities and includes modules, other response capacities and categories of experts.
- The role of rescEU is to respond to overwhelming situations as a last resort where existing capacities at national level and those pre-committed to the ECPP are not sufficient. The Commission identifies gaps, overall capabilities, and emerging risks at EU level, especially in the areas of aerial forest fire fighting, chemical, biological, radiological and nuclear incidents, and health emergencies, and defines, by means of implementing acts, the capabilities of rescEU. They are hosted by the Member States which acquire, rent or lease them. The Commission in close coordination with the concerned Member States decides for their deployment and demobilisation. The Union supports Member States by co-financing the development of rescEU capacities.
- In terms of risk management, Member States further develop risk assessments and the assessment of risk management capability at national or appropriate sub-national level and provide the Commission with a summary of the relevant elements by 22nd December 2019 at the latest. The Commission, in cooperation with Member States, can set up specific consultation mechanisms to enhance appropriate prevention and preparedness planning and coordination among Member States that are incline to similar types of disasters.
- The Commission support Member States prevention actions by organising knowledge sharing, exchange of experience in risk management assessment, and prevention and preparedness planning.
- A Union Civil Protection Knowledge Network, bringing together relevant civil protection actors and centres of excellence, universities and researchers, is set up. A training programme includes joint courses, exchange of expertise, as well as exchanges of young professionals and experienced volunteers. Research and innovation are stimulated.

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1.4. Legal framework of the Mechanism

The legal basis of the New Mechanism is the Decision of the European Parliament and of the Council on a UCPM – 1313/2013/EU and the Commission Implementing Decision № 2014/762/EU laying down rules for the implementation of Decision No 1313/2013 of the European Parliament and of the Council on a UCPM.

Figure 5. Decision No 1313/2013/EU of the European Parliament and of the Council of 17 December 2013 on a UCPM and involvement of 34 participating States in Framework for cooperation in disaster response, preparedness and prevention

There are two main pieces of legislation that cover European civil protection, these being Council Decision 2007/779/EC, Euratom establishing a Community Civil Protection Mechanism (recast) and Council Decision establishing a Civil Protection Financial Instrument (2007/162/EC, Euratom). The EU has an instrument that enables it to fund activities aimed at preventive action, preparedness and an effective response, particularly those carried out under the existing mechanism. This financial instrument covered the 2007-2013 period and replaced the Community action programme in favour of civil protection, established by Council Decision 1999/847/EC. Three Commission Decisions have been issued after the adoption of these two main pillars of civil protection legislation, each of them having a specific purpose within the meaning of the Council Decisions. One of these Decisions (2007/606/EC, Euratom) deals with laying down implementing rules for transport; the other two (2008/73/EC, Euratom and 2010/481/EC, Euratom) provide for the implementation of the modules concept. The Community Civil Protection Mechanism and the Civil Protection Financial Instrument together cover three of the main aspects of the disaster management cycle – prevention, preparedness and response. The Mechanism itself covers response and some preparedness actions, whereas the Financial Instrument enables actions in all three fields. The two pieces of legislation are moreover complementary as the Financial Instrument finances the Mechanism. There were two other legal texts that were the direct precursors to the current framework. The first dates back to 1999 establishing the Community Action Programme in the field of civil protection. A first two-years Action Programme (1998-1999) was followed by a five-years Action Programme (2000-2004). This was extended until 2006 through the Council Decision of 20 December 2004. The second major legal text was the Council Decision of 23 October 2001 establishing the original Mechanism. A later Commission Decision of 29 December 2003 laid down the rules for the implementation of the Community Mechanism, defining its duties and the functioning of the various tools made use of in the Mechanism. The tsunami that hit South Asia in December 2004 however beckoned a major overhaul of system as a whole. Both the Council and the European Parliament called on the Commission to explore areas of improvements to the Mechanism. This resulted in a series of Commission Communications aiming at developing a more robust European civil protection capacity, enabling the

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Union to react more rapidly and effectively to any type of disaster in the future. As a result, the Commission tabled a recast of Council Decision (2001/792/EC) on on 27 January 2006 intended to reshape the Mechanism. The Council Decision 2007/779/EC, Euratom was mainly based on this Communication. The Commission also adopted a Proposal for a Council Regulation establishing a Rapid Response and Preparedness Instrument for major emergencies on 20 April 2005. This proposal provided the future legal framework for the financing of civil protection operations. The Commission proposed a major increase in the future financing for European civil protection actions, with annual amounts ranging from €16 million in 2007 to €30 million in 2013. In doing so, the Commission recognised the importance of immediate civil protection assistance as a tangible expression of European solidarity in the event of major emergencies. Renamed the Civil Protection financial Instrument this legislation was adopted on 5 March 2007. The very foundations of civil protection co-operation at a Community level go back as far as May 1985 in the May ministerial meeting (Rome). Six resolutions were consequently adopted over the following 9 years. The results of these resolutions were a number of operational instruments covering both preparedness and response. Activities were organised on the basis of the subsidiarity principle laid down in the Maastricht Treaty. Of importance is the Resolution of 8 July 1991 on improving mutual aid between Member States in the event of technological disasters. The Commission Communication of 11 June 2002 described progress achieved in preparedness for emergencies, amongst others the set-up of a mutual consultation mechanism to deal with any crisis involving bioterrorist threats. Furthermore, a joint Commission - pharmaceutical industry task force was launched, that drew up an inventory of the availability and capacities of production, stockpiles and distribution of serums, vaccines and antibiotics likely to be used to counter any bacteriological attack. Other important legal basis are:

- Council Resolution of 22 December 2003 on strengthening Community cooperation in the field of civil protection research [Official Journal C 8 of 13.1.2004].
- The Council encourages the development of research projects on the reduction of natural and technological risks and on mitigating their consequences. It also encourages research institutes and other relevant entities to establish common objectives for preventing and reacting to natural or technological risks.
- Council Resolution of 19 December 2002 on special civil protection assistance to outermost and isolated regions, to insular regions, to regions which are not easily accessible, and to sparsely populated regions, in the European Union [Official Journal C 24 of 31.1.2003]. The Council considers that outermost, isolated, distant insular and sparsely populated regions should benefit from measures suited to their individual situations. In particular, it encourages joint projects between regions with similar characteristics and the taking into consideration of these characteristics when planning responses to emergency situations, setting up specialised intervention teams and developing effective, reliable and adapted communication systems.
- Council Resolution of 28 January 2002 on reinforcing cooperation in the field of civil protection training [Official Journal C 43 of 16.2.2002].
- The Council invites the Commission to look at any initiatives supporting the creation of a network of schools and training centres active in the field of civil protection and to give financial support to this initiative and involve the candidate countries in its work. The Commission is also invited to consider the possibility of creating a European civil protection college to perpetuate such cooperation.
- There are of course other legal texts, which are not, yet legislative pieces but contain proposals or observations, which will have a bearing on civil protection. These include the Commission Communication on Reinforcing the Union’ Disaster Response Capacity, the Communication on strengthening Early Warning System in Europe; and by the end of 2008 a document that will encompass a comprehensive prevention initiative.

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- Finally, it must be underlined that Civil protection of course ties in with many other policy initiatives. The link with climate change is inevitable, while chemical accidents and marine pollution incidents have triggered the Mechanism into action. Community initiatives on forestry, soil, water and telecommunications also have links with civil protection. This list is not exhaustive.

1.5. EU Civil Protection Mechanism Activations

Inside the European Union:

When a participating state is unable to handle a large national emergency, it may request assistance from the other participating countries through the ERCC, which receives the request and informs all the other countries involved. ERCC is responsible for communicating centres in the various countries. The request made by the affected country are matched by the system to offers of assistance from countries that decide to intervene. ERCC provides all the countries with information and updates on the emergency until it is resolved. The kind of intervention will vary depending on the event. The ERCC then facilitates dispatch of assessment and/or coordination teams, experts, civil protection modules and ensures co-funding of assistance transport offered by participating states, but management of aid is responsibility of the state requesting intervention.

Outside the European Union:

The Mechanism may be activated by an affected country with a request for assistance to the ERCC. In these cases, the High Representative for foreign affairs and foreign policy together with the Presidency of the European Council coordinates the political response, in collaboration with the Commission. This guarantees links with the affected country, facilitating rapid deployment of community assistance, above all during the initial hours of the emergency.

Figure 6. EU Civil Protection Mechanism operation scheme; Source: https://ec.europa.eu/echo/what/civil-protection/mechanism_en

If the United Nations are involved, they will assume management of operations. Activity is carried out by the European Commission Humanitarian Aid department – ECHO in close collaboration with the United Nations Office for the Coordination of Humanitarian Affairs – OCHA. The Mechanism through the MIC/ERCC was activated 223 times and oversaw 72 missions, deploying 246 experts and 64 liaison officers. Because the objective of the MIC/ERCC was to facilitate the immediate response efforts in the event of an emergency, it provided Participating States with a single entry point for civil protection information and coordinated the deployment of EU CP teams to

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affected areas. CECIS enabled communication and information sharing between the MIC/ERCC and contact points of the Participating States, (1) sending and receiving alerts and details of assistance required; (2) showing available assistance capacities; and (3) tracking the development of ongoing emergencies. 150 modules and 10 Technical Assistance Support Teams ('TAST') were registered on CECIS. Concerning the Detection and early warning systems, 13 were developed with the aim to reduce the impact of disasters by ensuring the timely and effective provision of information so that rapid actions could be taken. The **Transport of assistance** was developed in response to a transport deficit for addressing the logistical and financial burden associated with the transport of civil protection assistance by Participating States to country affected by a disaster. The Financial Instrument co-funded 134 transport operations (122 co-financing through grant, 9 co-financing through the Commission’s contractor and 3 combined co-financing). Some examples of the activations of the Civil Protection Mechanism can give an idea of its degree of response to natural and man-made disasters Examples from 2011 include assistance in the aftermath of the devastating earthquake and tsunami that hit Japan, help in the evacuation effort of European citizens and third country nationals from Libya and facilitating the delivery of the emergency assistance to Turkey following the October earthquake. In 2012 the Mechanism was activated to provide rapid assistance to fight destructive forest fires in Greece, Portugal, Montenegro, Bosnia Herzegovina and Albania. In 2014, the Mechanism was activated, following requests for assistance, on 19 occasions across the globe. In May 2014, the EU Civil Protection Mechanism was mobilised following a request for assistance from both Bosnia and Herzegovina and Serbia after devastating floods in the region. This was the largest EU response operation, with 23 participating countries offering teams and equipment. The following graph **(Figure 7)** gives an overview of the number of activations from 2002 to 2015, 2018 **(Figure 8)** and 2019 **(Figure 9)**.

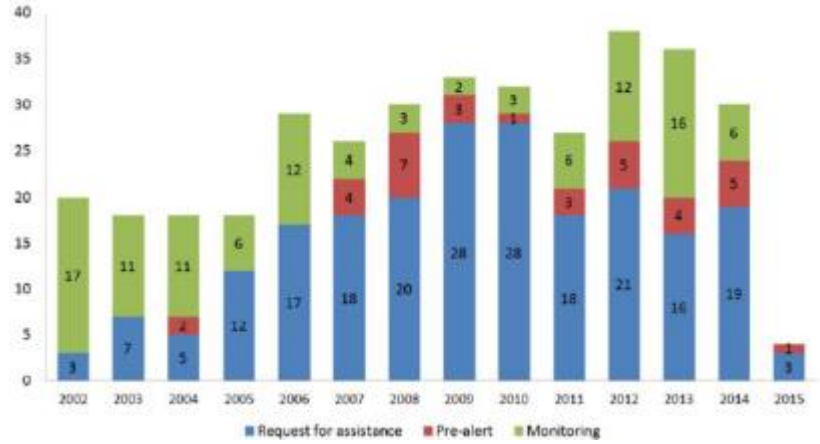

Figure 7. Number of activations of UCPM Mechanism (2002-2015); Source: EVANDE, The Cvil Protection policies and legal framework in Europe

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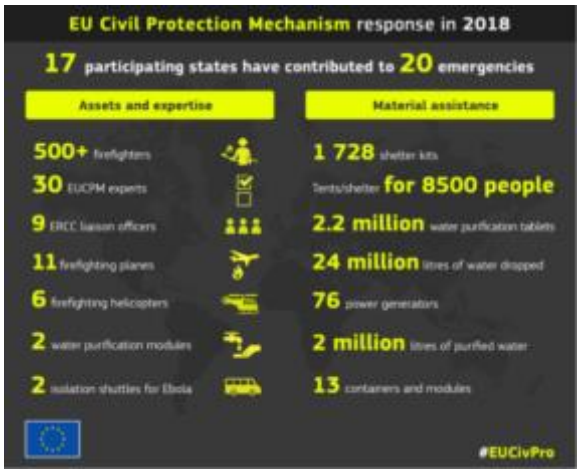

Figure 8. Mechanism response in 2018; Source: https://www.facebook.com/ec.humanitarian.aid/photos/a.377376547905/10156765362777906/?type=3

Figure 9. Mechanism activations in 2019; Source: https://ec.europa.eu/echo/what/civil-protection/emergency-response-coordination-centre-ercc_en

2. Training activities

The training programme is an essential part of the Mechanism. It is crucial in preparing experts for international civil protection assistance interventions inside as well as outside Europe. It also provides an excellent platform for experience-sharing and networking between national experts from participating countries. The programme involves training courses, joint simulation exercises and an exchange programme, where experts can learn first-hand about similar responsibilities under different national systems. Since it was launched in 2004, the training programme has developed and by now more than 10 courses (introductory, operational, management and refresher courses) were completed. These courses aim at enhancing the coordination of civil protection activities and enhancing the complementarity of the intervention teams. They also aim at making emergency response more effective. In total, more than 4,700 civil protection experts and specialists were trained since the Training Programme was launched. The target group is wide, which opens the training programme to many different categories of experts. These can range from assessment and coordination experts to specialists within a certain field of work, such as marine pollution experts, environmental experts (landslides waste management, dam stability etc), experts in geo-hazards or logistics in emergency operations, and medical staff. All courses combine theory and field experience, as well as international guidelines and standard operating procedures. They all contain practical exercises (field

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and table-top) based on different emergency scenarios where participants get the opportunity to practise their skills in a realistic setting. In order to benefit most, candidates are encouraged to follow courses according to a basic order. All courses conclude with a final test in order to review the progress of the participants during the course. A certificate is handed out at the end of each course providing the participant has attended the entire course. From the 11th cycle onward (mid 2013), candidates make use of a distance preparation tool. For each cycle of training courses, the total number of course places is divided between the Participating States and external organisations. This quota is based on the reported training needs of the country as well as the size of the country. To administrate training-related issues, each Participating State has appointed a national training coordinator who is responsible for identifying and nominating experts to attend the training courses. To increase collaboration with other international actors and facilitate cooperation in the field, partners such as other European Commission services, the United Nations and the Red Cross Red Crescent Movement are invited to participate in relevant courses.

3. Modules, exercises and exchange of experts

The European Commission organises a programme based on modules, exercises and exchanges of experts, as well as actions in areas where a common European approach is more effective than separate national approaches. Improving the quality of and accessibility to disaster information, implementing prevention measures, raising public awareness on disaster management, developing guidelines on risk assessment and hazard mapping, encouraging research to promote disaster resilience, and reinforcing early warning tools are some of the EU-level disaster prevention activities being developed and constantly upgraded.

3.1. Modules

The idea of establishing civil protection modules to strengthen the European response to natural and man-made disasters was launched by Member States in the wake of the December 2004 tsunami in South-Asia. In June 2005, the European Council endorsed the genera concept, calling for the establishment of an EU rapid response capability based upon Member States civil protection modules. Consequently, the Council Decision establishing a Civil Protection Mechanism emphasises the importance of developing a European rapid response capability based on the civil protection modules of the Member States. The Council Decision defines the civil protection modules and provides the Member States are required to identify modules within six months of the adoption of the Mechanism recast – meaning until 16 May 2008. The European Commission and Member States have worked closely together to develop the implementing rules for Civil Protection Modules. The implementing rules provide the technical framework for a total of 17 modules covering pumping and purification of water, aerial firefighting (planes and helicopters), USAR (heavy and medium), medical assistance including medical evacuation (advanced medical posts, field hospital, aerial evacuation), emergency shelter, CBRN detection and sampling, and search and rescue in CBRN conditions. Tasks, capacities, main components and deployment times are defined and the provisions give more details about the notions of self-sufficiency and interoperability. The rules also provide for a Technical Assistance Support Team (TAST) for the support and/or coordination of the teams and, under specified conditions, TAST is incorporated in specific modules to fulfil support functions.

The modules concept

- Modules are task and needs driven pre-defined arrangements of resources. They are assembled and made available to respond more quickly to emergencies both within and outside the EU. Standard Operating Procedures (SOPs) are defined and they contain all the predictable procedures during the deployment cycle. The modules are composed of mobile/moveable resources from Member States which can deployed abroad; are able to work independently as well as together with other modules and provide assistance inside and/or outside the EU to other EU bodies and international institutions, especially the UN; can be

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made up of resources from one or more Member States of the Community Mechanism on a voluntary basis; are self-sufficient, interoperable and can be dispatch at very short notice (generally within 12 hours following a request of assistance); are equipped, trained and operate in accordance with acknowledged international guidelines

- ***The types of EU CP modules are the following:*** High Capacity Pumping; Flood Containment Module; Flood Rescue Module using boats; Water Purification; Medium USAR; Heavy USAR; Aerial Forest Fire-Fighting using helicopters; Aerial Forest Fire-Fighting using airplanes; Ground Forest Fire Fighting; Ground Forest Fire Fighting using vehicles; Advanced medical post; Advanced medical post with surgery; Medical aerial evacuation of disaster victims; Emergency temporary shelter; CBRN detection and sampling; SAR in CBRN conditions; Field hospital and Technical assistance support team (TAST)

3.2. Exercises

The EU and EU member states invest significant resources into Civil Protection exercises. Civil Protection exercises organised at EU level are designed primarily as field tests aiming to establish a common understanding of cooperation in civil protection assistance interventions and to accelerate the response to major emergencies. The objectives of the exercises are “to improve civil protection preparedness and response to all kinds of emergencies, including marine pollution, chemical, biological, radiological, nuclear emergencies, as well as combined emergencies and emergencies simultaneously affecting a number of countries (inside or outside the EU) by providing a testing environment of established and/or new operational concepts and procedures of the Mechanism and a learning opportunity for all actors involved in civil protection assistance interventions under the Civil Protection Mechanism”. For this reason, these exercises provide a learning opportunity for all actors involved in operations under the Mechanism and enhance operational co-operation between them. One of the main objectives of these Civil Protection exercises is to enhance international cooperation. Contingency planning, decision-making procedures, provision of information to the public and the media can also be tested and rehearsed during these events, so as to be better prepared for similar real-life situations. Moreover, exercises can help supervisors identify further training needs for their staff involved in operations, while lessons-learned workshops organised in parallel can serve as a forum to identify operational gaps to be improved. The Commission Decision 2004/277/EC, Euratom of 29 December 2003 defines the target group of the exercises (Article 22) and the Exercise aims (Article 24). The exercise aims (Article 24) are reproduced below: "The exercises shall, in particular with regard to the target group set out in Article 22(a), aim at :

- Improving the response capacity and providing the necessary practice of the teams meeting the criteria for participation in civil protection assistance interventions;
- Improving and verifying the procedures and establishing a common language for the coordination of civil protection assistance interventions and reducing the response time in major emergencies;
- Enhancing operational cooperation between the civil protection services of the participating States;
- Sharing lessons learned.

As defined in the article 22 of Commission Decision 2004/277/EC, Euratom, the target groups of the exercises are:

- Participating States intervention teams
- Participating States' intervention team leaders, their deputies and liaison officers
- experts of the Participating States as set out in article 15 of the same decision (technical experts, assessment experts, coordination team member, coordination head)
- national key contact point staff
- officials of the European institutions

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The expected results of the exercises are:

- The existing procedures for the various elements of the Civil Protection Mechanism are improved and new procedures, where needed, are established.
- The interoperability of intervention teams is improved as the result of the exercise; in particular this will mean quicker dispatch time, improved cooperation arrangements, better communication between headquarters and field, identification of shortcomings in the existing structures.
- Participating States are aware and prepared to receive and to provide assistance through the Mechanism.

Types of exercises

Full Scale Exercises (FSE), involving a sufficient number of the various categories of the training programme target group, necessarily including deployment of intervention teams. A FSE is designed to replicate one or several phases of an emergency with the commitment of all the public bodies and authorities that would be committed in a real situation. All the functions (operation, command, logistics, communication, public information, etc...) of a real operation are replicated and played in a coordinated way. It is expected that the exercise is preceded by a tabletop exercise (TTE), and includes a command post exercise part. About 40 FSE over the last 13 years were organised.

Command Post Exercises (CPE), with a minimum and focused deployment in the field of a number of the categories comprising the target group of the training programme. It should be noted that the requirement of a minimum deployment in the field distinguishes the above command post exercises from the ones organised by the Commission as part of the CECIS training, the latter being "pure" command post exercises with no deployment in the field. A CPE is designed to put command structures in a real situation, requesting the deployment of an EUCP Team and possibly key staff of operational assets together with command and communication staff and tools.

Table top exercises or other type of discussion based exercises (TTE) as deemed suitable to achieve the set objectives. A TTE is designed to put real crisis managers in a situation to use existing plans and procedures to take decisions according to a proposed scenario. Being a discussion mode exercise, it does not require any deployment but gathers the players in one single location under the guidance and control of experienced staff. In all types of the above exercises, at least two coordination levels should be exercised. The scenario of the exercises takes into account one, several or all of the following phases: alert and request of assistance, deployment, operational engagement, operational disengagement. The scenario is related to any type of disaster that overwhelms the response capacity of the affected State. Pre-deployment is acceptable when realistic or when the objective of the exercise is more focused on operation and disengagement than on deployment. Natural and technological disasters (including CBRN events) are typically in the scope of Mechanism exercises, being at land or at sea. Experts and teams from third countries, with the appropriate qualifications, can participate as exercise players (article 7 of Council Decision 2007/162/EC, Euratom). Personnel of International Organisations and agencies, in particular those that form part of the United Nations system, can also participate as exercise players when relevant (see article 9 of Council Decision 2007/162/EC, Euratom). The exercise duration is a minimum of two days and two nights, except for TTE that can be limited to one full day. A team has to be dedicated to control the exercise, i.e. providing injects, information and reactions to the players through the channels set up in accordance with the local, national and international rules. This control team is not allowed to guide directly the decision making process of the players by imposing actions and a timeline, which should remain indicative in the planning of the exercise. Besides provision of injects, the role of the control team is to ensure that the activities of the players stay within the limits permitted by the resources dedicated to the exercise. Finally, concerning the geographical areas, there are no restrictions on the scenario is supposed to take place at. The scenario can evolve inside or outside the EU. Particular attention should be given to scenarios that take place in disaster prone areas. Anyway, the exercise location has to be in the territory of a Participating State of the Mechanism. In 2019 and 2020, six full-scale

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exercises for USAR modules, Emergency Medical Teams (EMT) and other Response Capacities were planned throughout Europe to train their preparedness for deployments in disaster affected areas. That includes an exercise (USAR) conducted in Bulgaria, Montana 12.06. – 15.06.2019. Currently the last exercises that has been conducted was in Portugal, Fogueteiro village 04.11. – 07.11.2019

Response

Response means facilitating the cooperation in civil protection assistance interventions in the event of major disasters inside and outside the EU. It deals with International collaboration and it embeds any action taken upon request for assistance under the Union Mechanism in the event of an imminent disaster, or during or after a disaster, to address its immediate adverse consequences. The new actions in disaster Response are related to; the Establishment of ERCC with 24/7 operational capacity; the establishment of a European Emergency Response Capacity consisting of a voluntary pool; the co-financing of buffer capacities to address temporary shortcomings; the seed-funding for new response capacities in very specific situations, where a potentially significant gap has been identified.

3.3. The strategic Operational centre – The ERCC

ERCC is the operational hub of the Mechanism for facilitating a coherent European response during emergencies inside and outside Europe. An immediate, coordinated and pre-planned response saves lives. The ERCC has been established exactly for this reason: to enable the EU and its Member States to respond to overwhelming natural and manmade disasters in a timely and efficient manner. The ERCC collects and analyses real-time information on disasters, monitors hazards, prepares plans for the deployment of experts, teams and equipment, works with Member States to map available assets and coordinate the EU's disaster response efforts. It monitors emergencies around the globe 24/7 and is able to deal with several simultaneous emergencies in different time zones Thanks to its pre-positioned and self-sufficient civil protection modules, the ERCC teams are ready to intervene at short notice both within and outside the EU. They undertake specialised tasks such as search and rescue, aerial forest fire fighting, advanced medical posts and more. The EU's disaster response coordination has evolved throughout the years, following a continuous increase in requests for assistance from all over the world. The ERCC therefore gives countries access to a one-stopshop of civil protection means available amongst the all the participating states. It acts as a communication hub at headquarters level between participating states, the affected country and dispatched field experts. Any country inside or outside the EU affected by a major disaster can make an appeal for assistance through the ERCC. In response, the ERCC matches offers of assistance to the needs of the disaster-stricken country. The countries participating in the Mechanism can commit some of their core resources on standby in a voluntary pool – ready to be instantly set in motion as part of a coherent European response when the need arises. Better planning and the preparation of a set of typical disaster scenarios can further enhance the ERCC´s capacity for rapid response. To ensure highest quality standards, this emergency response capacity will include a certification process for the resources made available to the pool. The ERCC will initiate a process of identification of eventual gaps in the panoply of European assistance and of proposals on how these gaps can be covered, through financial support from the EU or other means. By merging the current Crisis Room for humanitarian crises and the MIC for civil protection, the ERCC fosters increased cooperation between the civil protection and humanitarian aid operations. The ERCC keeps direct links to the civil protection and humanitarian aid authorities in Member States which enables a smooth and real-time exchange of information.

3.4. European Emergency Response Capacity (EERC) consisting of a voluntary pool

A European Emergency Response Capacity is established and the Member States shall on a voluntary basis identify and register the response capacities. The EERC consists of a voluntary pool

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of pre-committed response capacities of the Member States and include modules, other response capacities and experts. On the basis of identified risks, the Commission defines the types and the number of key response capacities required for the EERC ("capacity goals") and defines quality requirements for the response capacities that Member States which are based on established international standards. Response capacities that Member States make available for the EERC are available for response operations under the Union Mechanism following a request for assistance through the ERCC. When domestic emergencies, force majeure or, in exceptional cases, serious reasons prevent a Member State from making those response capacities available in a specific disaster, that Member State shall inform the Commission as soon as possible. The Volontary Pool cycle is described below **(Figure 10)**

Figure 10. European Emergency Response Capacity essence

Where potentially significant gaps have been identified, the Commission shall examine whether the necessary capacities are available to the Member States outside the EERC and it will encourage Member States to address, either individually or through a consortium of Member States cooperating together on common risks, any strategic capacity gaps that have been identified. The Commission may support Member States in those activities also through the seed-funding for new response capacities in very specific situations, where a potentially significant gap has been identified, following the process described below **(Figure 11).**

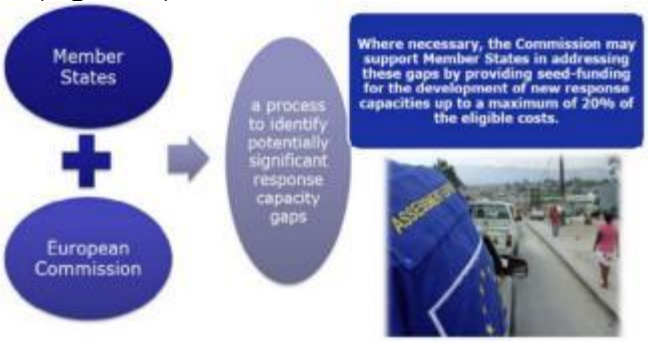

Figure 11. European Emergency Response Capacity seed-funding in specific situations

4. Best Practices

4.1. Floods in Serbia, Bosnia and Herzegovina, 2014

Due to continuous rainfall that started on 13 May 2014, extreme floods hit Serbia and Bosnia and Herzegovina, affecting and displacing thousands of people. It is estimated that over 3 million people in both Bosnia and Herzegovina and Serbia were directly or indirectly affected by the floods, mudslides and landslides. Hundreds of thousands of people lost their livelihoods and were evacuated from their homes. Provision of clean water, health and sanitation was one of the main concerns.

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Across the region, key infrastructure, including bridges and roads as well as health and educational facilities, were damaged in many affected areas. This practice is related to the UPCM activation in the field of preparedness and effective coordinated response to disasters. It’s a practice presented by Yves Dussart (DG ECHO Civil Protection Policy Unit) during the conference titled *“Conference on natural disasters and ‘one health’, are we prepared?” held in Brussels on 16 and 17th April 2015. The tile of the intervention was “Member states collaboration, the role of the European Union through the EU civil protection mechanism”.*

Serbia experienced the most catastrophic floods unprecedented in its history. A State of Emergency was declared for the whole Republic from 15 – 23 May.

- 40 municipalities and 1.6 million people were affected.
  The Municipality of Obrenovac (near Belgrade) was mostly affected (90% flooded).
- 485 housing units have been completely destroyed by the floods and landslides. 16.200 houses were damaged.
- Infrastructure, Health Sector, Environment and Education sector heavy affected. Losses mount to EUR 1.5 billion.
- 60 casualties have been reported during the emergency – 26 as a result of drowning.
- 31.879 people were rescued and evacuated, 180.000 were in need of assistance.

Request for assistance through the UCPM

On 15 May Serbia has requested assistance through the UCPM in form of High Capacity Water Pumping (HCP) modules.

- Due to worsening of the situation, on 16 May 2014 a second request for HCP modules, flood rescue teams with boats and helicopters for rescue and evacuation operations of the affected people; chemicals for suppression of larvas and adult forms of mosquitoes,
- On 23 May, a third request for assistance followed for Water Purification Teams.
- Assistance was provided by 9 Participating States (22 teams, with 563 members): Flood Rescue Teams; Helicopters; High Capacity Water Pumping; Water Purification Teams

The Floods in Bosnia and Herzegovina: Situation overview

Continuous rainfall (4 months of rain fell in just three days) started on 13 May and led to exceptional flooding in many parts of Bosnia and Herzegovina.

- Over 3.000 landslides were triggered, landmines were uncovered - boats or helicopters provided the only possible evacuation methods.300.000 inhabitants were directly affected.
- More than 1 million of people were hit by the flood indirectly.
- Roads, infrastructure houses and entire villages were swept away.
- In Posavina Canton, floods killed number of Poultry Cattle and other animals. Serious epidemiological situation as dead animals still in the water.

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Needs boats and personal equipped with sanitary and hygienic items to pick up dead animals and move them to incinerators.

ERCC/ UCPM response for both countries

23 EU Member States provided in-kind assistance, such as rescue boats, helicopters, high-capacity pumping modules and water purification units (in detail the Member States offering assistance have provided via the EU Civil Protection Mechanism: 2 helicopters, 22 high capacity pumping modules, 111 pumps, 39 rescue and 15 water purification modules. In addition, 11 000 water purification tablets, 14 000 blankets and more than 1 000 tents have been channelled through the EU Civil Protection Mechanism to the flood victims in Bosnia and Herzegovina. All this equipment has been deployed with and operated by more than 800 relief workers from EU Member States who have been working on the ground in the two countries. The teams deployed through the EU Civil Protection Mechanism directly rescued over 1700 people in Bosnia and Herzegovina alone. The European Commission's ERCC has been in constant contact with the relevant authorities in Serbia and Bosnia and Herzegovina to match the incoming offers for assistance with needs on the ground. EU Civil Protection Teams were deployed to Serbia and Bosnia & Herzegovina in order to assist the national authorities in their response to the wide scale flooding and to support the coordination of the incoming EU assistance. This assistance has helped save lives, pump out water from flooded buildings, maintain electricity access, deliver supplies to affected areas, predict water flow evolution, and assess the damage through satellite images providing clean drinking water including water purification tablets and the repair of wells, food, hygiene and household kits, blankets and mattresses.

The European Commission co-financed the transportation of relief material and personnel costs to deliver aid to the affected areas. In addition,

- More than 800 relief workers with their equipment deployed through the UCPM.
- ERCC deployed 4 EUCP coordination and assessment teams to support coordination on site. In total 26 experts and 6 ERCC LO's.
- EUR 430 000 has been requested by the Participating States of the Mechanism to co-finance transportation costs of Assistance. Over 40 grant requests were processed.
- 80 Satellite maps of the flooded areas via the Copernicus Emergency Management Service were produced by the Commission to support both the affected countries and those providing assistance
- 4 experts deployed through UCPM for Post Disaster Needs Assessment (PDNA).

On top of the in-kind assistance provided by the EU Member States via the EU Civil Protection Mechanism, the EU also released € 3 million in humanitarian aid to address the most immediate needs and to help the most vulnerable population in the two affected countries. The funding, channelled through the Red Cross/Red Crescent and other partner organisations on the ground, fills some of the most critical gaps and immediate needs in the two countries. Based on the findings of the needs' assessments, the EUR 3 million funding is used mainly for the provision of clean drinking water including water purification tablets and repair of wells, provision of food, hygiene and household kits, blankets and mattresses. It also ensures access to assistance for all vulnerable groups and minorities. It

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is estimated that the funding provided humanitarian assistance to some half a million people. As the situation evolved, the EU mobilised to support the recovery and reconstruction of Serbia, Bosnia and Herzegovina. For this purpose, EUR 62 million was allocated by the European Commission to respond to short to medium term needs in the affected areas. This funding was re-allocated from previous programmes under the Instrument for Pre-Accession Assistance (IPA). The money included support for public infrastructure such as schools and social care services as well as basic equipment for enterprises and farms to restart their activities.

4.2. Implementation of the EU Civil Protection Mechanism during the COVID-19 Pandemic

- **Repatriation of EU Citizens**

The EU Civil Protection Mechanism has been widely solicited by member states to support their reaction to the COVID-19 outbreak. On January 28, 2020, the European Commission announced that the EU Civil Protection Mechanism had been activated at the request of France to repatriate EU citizens present in Wuhan (China). France and Germany were thus able to repatriate almost 500 EU citizens with the financial support of the EU by the end of January. On February 21, Italy and the United Kingdom activated the Mechanism to repatriate EU and UK citizens held aboard the cruise ship Diamond Princess, moored in Yokohama (Japan). Austria, Denmark, and Germany equally requested assistance through the Mechanism to organise repatriations. Since the beginning of the outbreak, more than 45,000 EU citizens, UK citizens, and citizens from participating states have been repatriated by means of flights, of which 75 percent have been financed by the EU.

- **Assistance to China**

The EU Civil Protection Mechanism also supported the supply of more than 56 tons of personal protective equipment to China (protective clothing, disinfectants, and medical masks) from Austria, the Czech Republic, Estonia, France, Germany, Hungary, Italy, Latvia, and Slovenia. The first twelve tons of equipment were transported by the same aircrafts that were mobilised to organise the repatriations of EU citizens at the end of January 2020. On February 14, Italy sent an additional 1.5 tons of protective equipment to the Chinese Red Cross. On February 19, France sent an aircraft with 20 tons of surgical masks, gloves, thermometers, and disinfectant, partly supplied by Estonia and Latvia. Austria did the same on February 23.

- **Failure to Assist Italy**

On February 26, Italian authorities made their own request through the EU Civil Protection Mechanism to get additional protective equipment (masks, in particular). Although the Commission relayed this request, the EU member states did not provide any support to Italy. Retrospectively, this sheds a particular light on the assistance provided to China in preceding days and it questions the "spirit of solidarity" proclaimed in the TFEU. On March 14, because of vital needs in the EU, the Commission eventually ruled that exportation of medical equipment outside the EU would be subject to an export authorisation by member states.

- **Assistance to Western Balkans**

As a result of the coronavirus outbreak, the Western Balkans have also activated the UCPM and have already started to receive assistance through delivery of equipment and repatriation of citizens from the UCPM member states and participating states. Furthermore, given their European perspective, the EU is treating the Western Balkans as privileged partners by granting them access to many initiatives and instruments reserved for EU Member States.

- **Specific RescEU Medical Stockpile**

On March 19, 2020, while nearly 200,000 cases and 8,000 deaths had been reported worldwide, the Commission decided to create a specific rescEU medical stockpile as part of the existing rescEU reserve in order to support EU member states in their response to the COVID-19 pandemic. This specific stockpile was announced as comprising respirators, masks, laboratory equipment, treatment,

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and vaccines of which 90% would be financed by the Commission. It was supposed to be hosted by member states, but its deployment would be managed by the ERCC of the Commission. The stockpile enables the swift delivery of medical equipment such as ventilators, personal protective equipment, vaccines and therapeutics and laboratory supplies. The decision to create a specific rescEU medical stockpile has come in quite late considering that the creation of the rescEU reserve dates back to March 2019. The Commission was at the time supposed to "define the capacities rescEU shall consist of, taking into account identified and emerging risks, overall capacities and gaps at Union level, in particular in the areas of emergency medical response." Yet, the Commission adopted an implementing decision on a rescEU medical stockpile only after COVID-19 was characterised as a pandemic by the World Health Organisation, on March 11. The global shortage already constituted a significant obstacle to the effective constitution of this stockpile. Yet, this last-minute massive procurement could have been anticipated months ago; not only was the COVID-19 pandemic known by experts as a plausible scenario but, as we have seen, the Commission and EU member states precisely had conceived the proper legal tools to constitute a medical reserve in advance and be better prepared to face such a catastrophe.

- **Deployment of the European Medical Corps**

Lastly, a team of European doctors and nurses from Romania and Norway was eventually dispatched as part of the European Medical Corps to the north of Italy to help local medical staff, on April 7. This measure has been long expected by Italy which, as of April 6, had reported the highest number of deaths worldwide (15,889), ahead of Spain (12,418) and the United States of America (9,657). While it appears very belated, the deployment of the European Medical Corps is an important symbol of European solidarity, which is definitively not an empty shell despite all the shortcomings revealed by the COVID-19 pandemic.

5. Case studies

Example of case study - Union Civil Protection Module Exercise in Estonia, February-March 2017

5.1. Context and nature of the exercise

This case study reports on consultation and observation activities carried out during the module exercise (MODEX) held in Estonia between the 27th of February and 2nd of March 2017, The aim of the exercise was to provide an opportunity to test, learn from and improve the response capability of Participating States in a controlled environment, as well as to meet general and specific learning objectives for both European Union Civil Protection Team (EUCPT) and modules. Specific response capacities were tested during the MODEX, together with self-sufficiency, interoperability, coordination and SOPs of response teams and equipment. The field module exercise was carried out with the aim of training USAR teams from Austria, Czech Republic and Hungary, as well as ICT Helpdesk from Sweden and an EUCPT expert team. Most of the exercises took place on the training ground of the Estonian Rescue Board (ERB) and aimed at testing operations in cold conditions in an urban area. The average temperature during this period was 0°C and most of the field exercises, including key injects introduced by the Exercise Control Team, took place in the dark, due to short daylight in February.

5.1.1. Fictional activation of the mechanism

The fictional scenario developed for the exercise focused on rescue actions following a major earthquake, with a number of powerful aftershocks, devastating the Estonian region of Väike-Maarja. The local government reported a number of collapsed villages in the Väike-Maarja district. The focus of the ERB was Rakvere, a city with many collapsed houses. This issue caused conflict between the city and its suburban areas, as the latter felt forgotten by the rescue services and by the government. ERB in the scenario had run out of resources and could not anymore provide support to the areas around the city.

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5.2. Key messages and findings

5.2.1. Effectiveness

Generally, the learning experience of the Estonia MODEX was perceived by participants as very positive, though certain potential improvements were highlighted through interviews or followed from observation activities. Module exercises are generally seen as a good way to strengthen the UCPM and to ensure that the European response to disasters is conducted in an effective as well as efficient manner. In addition to the evidence gathered on general UCPM features, such as visibility and lessons learnt, observers assessed the effectiveness of modules, the EUCPT and coordinating structure against the following types of learning objectives: Self-sufficiency; Procedures; Interoperability; Coordination; Learning opportunity; and Specific learning objectives.

5.2.2. Lessons learnt

The case study found that lessons are perceived to be not sufficiently transmitted from exercises to other preparedness activities (particularly trainings) and vice versa. While the different consortia organising MODEX generally make use of the knowledge acquired in each exercise and adjust further exercises accordingly, this knowledge is not necessarily systematically stored. It may therefore partially get lost when a different contractor takes over, affecting continuity. Although, for example, the organisers of the Estonia MODEX reported to have regularly fed back to DG ECHO points for improvement, as well as experiences gathered in each exercise in order to foster lessons learning (e.g. particular issues with the EUCPT with the use of the Virtual OSOC), this does not yet amount to systematic knowledge-building. A more efficient system for extracting lessons learnt in MODEX exercises and making them available to all stakeholders, at Commission level, would ensure systematic knowledge storing and sharing, enhancing sustainability UCPM training. Among the participants in the Estonia MODEX, several members of the trainer team regularly act as trainers in UCPM training programme courses. Within this dual role, they try to export some of the lessons learnt during the exercise into training courses. It is in this context that some stakeholders suggested the establishment of “trainer forums” where issues and lessons learnt can be discussed and applied in future UCPM trainings, a valuable source of knowledge for putative systematic collection. One very positive aspect to building on knowledge acquired was the EUCPT refresher training organised prior to the start of exercise operations. Previous exercises had shown the need for EUCPT experts to better apply the required theoretical knowledge to the practical activities carried out during a MODEX, especially with regard to coordination and procedures. Such need was covered through the refresher training, and was unanimously perceived as a good practice to be replicated in further module exercises.

5.2.3. Self-sufficiency

All teams involved in the exercise showed an overall good performance with regard to self-sufficiency. Camp set-up was done professionally through the use of appropriate equipment, and in an independent manner. Modules and host country support had sufficient power generation capacity for lighting and all other electricity needs throughout the operation. No outage was observed or otherwise noted. Teams communicated well internally but there was no evidence of significant communication between teams other than on site, where external demands required such communication and when teams on very few occasions worked together (e.g. in joint assessments). It was particularly noted that each team set up a separate camp area, with no indication of shared resources or efficiency gains from setting up a joint camp. All modules handled their transportation needs independently and were not a burden on the host country. EUCPT transportation in absence of the TAST was provided by host country support. While the Base of Operations (BOO) was set up well and initial planning had considered space needs of all expected units (EUCPT, ICT, AT, CZ, HU), additional space was not necessarily considered/ kept available for potential reinforcements. In the absence of a TAST, set-up for EUCPT was slightly delayed, affecting the effectiveness of the initial coordination by the EUCPT.

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Very good performance was observed in relation to power generation and lighting, sanitation and hygiene, food and water, equipment storage and maintenance.

5.2.4. Procedures

The reception and departure centre were supportive of learning in a realistic environment, and was used by participants to manage “virtual” arrivals and departure as part of the exercise. The BOO was set-up well and functioned efficiently throughout the exercise. The USAR Coordination Centre (UCC) was tested for the first time in a module exercise, and the module in charge set up a well-organised centre, handling its function well. Safety and security were guaranteed throughout the entire duration of the exercise and over the work of the modules. At no point during the exercise it was observed and there was any sense of teams rushing or taking shortcuts in applying USAR techniques. The Safety and Security officers were always clearly visible and available for the modules at the sites where they were working.

5.2.5. Coordination

The quality of coordination between actors involved in the exercise could be observed and analysed on the basis of different levels:

- ***Coordination between On-Site Operations Coordination Centre (OSOCC) and modules and teams:***

While the coordination structure was clear from the beginning of the exercise, the coordination between the On-Site Operations Coordination Centre (OSOCC) and modules appeared to be difficult at start and improved over the duration of the exercise. The EUCPT Team Leader correctly delegated the USAR Coordination Centre (UCC) to a module, freeing the OSOCC from the inter-module coordination. Information flow from the UCC to the OSOCC worked after both had established themselves. Injects ensured a high frequency of meetings especially after the first day. After the exercise it was clear that all players involved in coordination experienced the exercise as a steep learning curve, including the modules who for the first time practised the operation of an UCC;

- ***Coordination and communication with international organisations:***

The EUCPT communicated well with all external actors, particularly after the establishment of the OSOCC tent. Generally, the quality of the EUCPT’s coordination seems to depend on team members’ experience. Due to the size of the expert pool, it appears that not many experts have ever been exposed to a simulated mission or to the international system. The trainings do not appear to be giving a sufficient basis for an effective coordination role in a real mission, particularly in relation to the EUCPT Team Leader role;

- ***Communication with ERCC in Brussel:***

The video conference with the ERCC was a good learning element for the EUCPT. Inputs and additional information from the ERCC focal point helped the EUCPT in clarifying and more effectively report on results and needs. The conference however required a strong leading role from ERCC in order to obtain the necessary information from the EUCPT experts, underlining the limitations of prior experience of the EUCPT members.

5.2.6. Interoperability

Modules generally worked on separate sites, providing little or no opportunity to share or combine equipment. In any case, in the observed modules (USAR) equipment was predominantly self-powered (i.e. using combustion engines and not electric power that would require cabling and generators on site that could be shared). The EUCPT was the element were most interoperability gaps could be identified through observation. At the start of the exercise, experts were given a refresher training on their roles and responsibilities, and all members had received previous trainings in their role. Despite this chance to prepare as a team, the initial team meeting appeared incoherent. It also lacked required leadership and decision-making. Some good decisions were made nevertheless, such as the delegation of Base of Operations (BOO) to one team member together with the one of the modules. Furthermore, the ICT team was available and free in the first 12 hours to support EUCPT

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set-up, but the opportunity for early set-up of tent space, heating and power was missed, thus highlighting room for improvement in the coordination between the EUCPT and other modules/ TAST (although a TAST was not deployed, host country support was tasked to provide a similar role).

5.2.7. Learning opportunity

The level of realism of the exercise was questioned by some stakeholders consulted. The Estonia MODEX was clearly perceived as an exercise, and participants did not appear to be in “mission mode”. It was reported, however, that the workload, duration and continuity of the exercise (e.g. through injects, the OSOCC element, the UCC, the Local Emergency Management Authority simulation) created sufficient pressure to have the required learning effect. Further evidence of such feedback was also collected through observation. On site, teams were deliberating options, carefully debating approaches, and seemed to carry out rescue operations “textbook style” in what they clearly perceived as a learning environment. There is scope for an enhancement of the sense of urgency, efficient and fast decision-making, and equally efficient and fast execution of decisions. Despite the potential exposure of teams to somewhat higher risks brought by enhanced realism, the safety environment was sufficiently sound and the scenarios sufficiently well set-up (as outlined above) to allow some limited risk-taking in executing rescue operations.

5.2.8. Relevance

Relevance of module exercises against training needs is currently assessed and planned at Commission level, where decisions on modules to be included in each lot of exercises are taken. Scenarios and practical needs are then discussed between DG ECHO and the different consortia organising module exercises through meetings. At the moment, MODEX do not seem to be organised on the basis of a thorough needs assessment that accurately reflects the training needs of Participating States. Stakeholders affirmed that, particularly in the case of module exercises, demand should be more driven by a combination of needs identified by Participating States on one hand, and from a general all-encompassing UCPM needs assessment which would feed relevant needs identified through the whole range of prevention, preparedness and response activities into the training objectives of MODEX. Furthermore, in order to effectively plan the execution of module exercises, DG ECHO should be able to receive information on training needs of Participating States well in advance (at least two years before). Nevertheless, there are numerous positive developments in terms of the relevance of module exercises. Prior to the start of the exercise, staff from participating modules are asked whether they have specific needs and objectives to be tested, and the exercises are usually adapted to such specific needs, showing flexibility. There was also evidence of operational learning from past exercises. The need to include more than one Safety Officer was identified in a MODEX carried out in Italy in 2016. In the Estonia MODEX, one safety officer was assigned to each team, allowing a better coordination between safety officers and trainers as well as between the modules’ Team Leaders and the safety officers.

5.2.9. Coherence

This criterion was analysed on the basis of evidence gathered on the internal coherence of the module exercise with other UCPM activities. There is no clear operational link between UCPM trainings and module exercises (with the exception of the Module Basic Course) according to some of the stakeholders consulted. The way training courses are currently implemented gives Civil Protection experts an overly theoretical knowledge of tools and practices to be used in a deployment, and trainers interviewed reported a general lack of ‘hands-on’ skills on how to utilise such tools in practice. Furthermore, the large size of the pool of “trained and deployable” experts has a reflection in module exercises, particularly in the selection of the Team Leader of the EUCPT team. Stakeholders reported that while a large amount of experts participate in management training courses, stricter criteria should apply for the selection of the expert tasked with the management of an emergency and coordination of the whole EUCPT team. At Commission level, there is currently no common

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exercise-training strategy. It was suggested to create one working group strategically covering both activities.

5.2.10. Efficiency

Generally, the procedures followed by DG ECHO for the organisation of the exercise were perceived as satisfactory by stakeholders involved. The timeframe given to Participating States for their internal planning and preparation of modules (currently 3-4 months) is appropriate and in line with legal requirements (e.g. notification periods for air transport which cannot be waived in a shorter timeframe unless for an emergency case) as well as with the potential for maximising the learning experience. Furthermore, modules' Team Leaders considered the lack of advance information on the exercise environment and tasks as an excellent feature of their team's learning objectives. However, in the case of the EUCPT, DG ECHO could consider implementing a formula through which the actual date of the exercise is not communicated too much in advance to experts (e.g. by providing a timeframe rather than the exact dates). Such a change would contribute to maximise the realism of the MODEX and provide EUCPT experts with a stronger "mission" experience.

5.2.11. EU added value

Participating States see Module exercises as a strong resource for testing the international logistical capacity of their Civil Protection modules. Modules' Team Leaders reported that such international learning opportunity contributed to better understanding and planning best options for long distance deployments, which are rather difficult to assess during exercises carried out at national level.

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II. Comparative research and presentation of green practices, necessary and proven effective approaches/concrete green measures for maintenance of sustainable ecosystems, improvement of the soil, air and water and identification of working and applicable models in the waste management field

DENMARK

1. Green practices in Denmark

1.1. Effective approaches and green measures for maintenance of sustainable ecosystems and improvement of the soil, air and water in Denmark

Measures towards circular economy

Many activities contribute to a circular economy in Denmark, and eco-innovation is a tool in that process. In 2015 Denmark launched a strategy for waste prevention. Denmark without Waste II’ with 72 initiatives closely linked to circular economy. The Strategy has two cross-cutting topics, Transition in Danish businesses and Green Consumption, and five action areas: Less food waste, Construction, Clothing and textiles, Electrical and electronic equipment, and Packaging. The government set up the Advisory Board for Circular Economy in October 2016, consisting of 12 industry leaders. The Advisory Board's aim is to devise a vision and targets for the transformation of Danish industry to a more circular economy by 2030, and to make recommendations for specific initiatives able to encourage the transformation, including those that industry is able to launch itself.

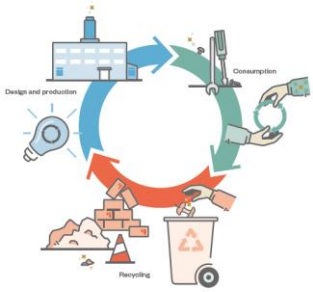

Figure 12. Value chain - design, consumption and recycling, Source: Recommendations for the Danish Government, The Advisory Board for Circular Economy, June 2017

Between November 2016 and May 2017, the board held four meetings and six committee meetings focusing on certain sectors with the greatest potential (food products, building and construction plus industry) and the different links of the value chain **(Figure 12)** design, consumption and recycling. During the process, the board consulted a wide range of stakeholders and set up an open web portal to receive external input. Over 120 suggestions for ideas were received as a result of dialogue. Qualified feedback was given on 23 March 2017 to initial thoughts on the circular economy from 300 delegates to a conference held at The Confederation of Danish Industry.

Eco inovations

The Danish Eco-Innovation Program dates back to 2007. MUDP promotes the development and application of new efficient environmental solutions to environmental challenges while simultaneously supporting growth and employment. The general focus of MUDP is on: water; climate

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change adaptation; circular economy and recycling of waste; cleaner air; less noise; fewer hazardous chemicals; the industry's environmental performance; and ecological and sustainable construction (Danish Environmental Protection Agency). With an overall score of 167, the 2015 Danish eco-innovation performance scores first place, up from second in 2014. Denmark has never been ranked below fourth place (2013) in the Eco-innovation scoreboard during 2010-2015. Denmark has 40 EMAS registered organisations or 7 registrations per million inhabitants, which is around the EU average (8 registrations per million inhabitants). Concerning the EU Ecolabel, Denmark has 4916 licenses or 9 registrations per million inhabitants which is more than double the EU average (4 registrations per million inhabitants).

Practice eco innovation

The Danish Green Investment Fund is an independent state loan fund with the purpose of co-financing economically viable projects that facilitate and support the sustainable development in Denmark. The fund seeks to bridge the gap between traditional bank financing and equity capital. In the field of eco-innovation, under the Danish Eco-Innovation Program the Board decided that the generation of waste were published in "Moving towards a circular economy –successful Nordic business models” (NordicCouncil of Ministers, 2015). Priorities were given to projects that:–Contribute to achieving the objectives of the “Vandvisionen 2015” of doubling the export of Danish water technology by 2025 and the objective to create a more efficient water sector.–Increase the quality and efficiency of water and waste supply management.–Promote circular economy by ensuring better (re)use of resources and waste; reduce harmful emissions and chemicals of concern in products and materials.–Help to reduce fine particle and flue gas emissions from industry and transport.–Support climate adaptation in such way so that the preservation of the countryside can go hand in hand with the protection of coasts and cities against erosion and flooding.

Environmental funding and investments

Denmark has had a progressive green policy backed by an ambitious policy framework, a multiple-solutions approach and necessary funding. The Danish Government that came into power in June 2015 has taken a more business- and market-oriented approach to sustainability, where cost effectiveness plays a key role while promoting growth and employment at the same time. The global perspective of Danish clean energy technology and services is being emphasised both in terms of dealing with climate change and as way creating jobs and business for Danish companies, which is also visible in the mandate of the EUDP programme. Examples of the global perspective and Danish involvement are P4G - a network of world leaders seeking breakthroughs in green economic growth - and Mission Innovation - a global initiative of 22 countries and the European Union to dramatically accelerate global clean energy innovation. While the ‘new’ Danish Government closed the Green Transition Fund (Grøn Omstillingsfond) in 2015, green transition is included in the 2016 governmental platform (Regeringen, 2016), and it set up the Advisory Board for Circular Economy which has delivered 27 recommendations (June 2017), and appointed the Energy Commission which presented (April 2017) its recommendations laying out an ambitious energy policy to the Danish Government, which is to be included in the process of defining energy policy for the next phase of Denmark’s green transition. Following the recommendations of the Advisory Board for Circular Economy the Danish Government has said that it wants to allocate funding of DKK 20 million (approx. EUR 2.7 million) annually in 2018-2019 and DKK 10 million for 2020-2021 for circular economy initiatives. In addition, the Danish Ministry of Environment and Food, and the Danish Ministry of Industry, Business and Financial Affairs wants also to allocate similar amounts to circular economy activities (DAKOFA, 2017b). The Danish Government has launched (October 2017) a comprehensive strategy for growth through the sharing economy and includes 22 initiatives that will make it easier to be part of the business economy and more attractive to the consumer while ensuring tax payments (Danish Ministry of Industry, Business and Financial Affairs, 2017). Moreover, through financing from the Danish budget, Statistics Denmark developed between 2015 and 2017 a series of

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environmental-economic accounts – the Green National Accounts – which resulted in the publication of the report “Green National Accounts for Denmark 2015-2016”. There is also the independent economic advisory body Chairmen of the Danish Economic Council of Environmental Economics which since 2008 has published yearly reports and the most recent one (2018) focuses on Danish climate policy (Danish Economic Councils, 2018). Furthermore, evaluation of different government programmes has taken place, e.g. the Danish waste strategy (2017), MUDP (2017) and EUDP (2015). The results in the case of EUDP was taken into consideration into the EUDP Strategy for 2017-2019. Local and regional governments are very much the current drivers in the transition to circular economy. Despite no dedicated, for time being, funding for circular economy, local and regional governments are preparing circular economy strategy and position papers that soon will be presented and implemented and building already good cooperation between the two administrative levels on circular economy, the links are being intensified. A number of Danish municipalities and regions, together with one Ministry, are members of ‘Partnership for Green Public Procurement’ (Partnerskab for Offentlige Grønne Indkøb) is a collaboration between public organisations that wish to make environmental efforts through procurement. Nordic cooperation through the Nordic Council and the Nordic Council of Ministers is important and common policies have an impact on member countries. There is a strong platform for green growth that has emerged between the Nordic countries– Green Growth the Nordic Way (Norden, n.d.).

Innovation Fund Denmark

Innovation Fund Denmark invests in entrepreneurs, researchers and businesses that create value for Denmark and new solutions to society’s challenges. For example new climate mitigating solutions, healthier food, a more effective health care, cleaner environment, green transport, start-up journeys – and much more.

The Advisory Board for Circular Economy

In 2016 the Danish Government established the Advisory Board for Circular Economy consisting of 12 CEO's and firm leaders from big as well as small Danish companies (Ministry of Environment and Food of Denmark, n.d.a). On June 7th 2017 Advisory Board delivered a report (Advisory Board for Circular Economy, 2017) with 27 recommendations for specific efforts Denmark can promote in order to encourage the transition into a circular economy. The Board’s states that: “Our vision is, that by 2030 Danish industry is a global leader within development, implementation and export of circular solutions, and that Denmark is world-renowned as a hub for the circular economy” (Advisory Board for Circular Economy, 2017). The recommendations are formulated in four general themes: 1) The circular value chain; 2) Design and production; 3) Consumption; 4) Recycling.

Green National Accounts

The Danish Government allocated in the national budget funding for a three-year project ‘the Green National Accounts - for Denmark’ that lasted from 2015-2017. The project developed a full set of environmental-economic accounts for Denmark according to the principles of the international statistical standard. The final outcome was the report - “Green National Accounts for Denmark 2015-2016. The publication highlights the relationships between the economy and the environment and comes to the conclusion that a decoupling between growth in GDP and growth in greenhouse gas (GHG) emissions has taken place in Denmark. (Statistics Denmark, 2018)

The Danish Economic Council of Environmental Economics

The Environmental Economic Council was established by law in 2007 and is one of two councils of the Danish Economic Councils (www.dors.dk), which provides independent analysis and policy advice to Danish policy makers. The Environmental Economic Council has 24 members representing unions, employer provide independent analysis and policy advice to Danish policy makers s, NGO's and the Danish Government. The members meet once a year to discuss a report prepared by the Chairmanship. The Environmental Economic Council. Each year Environmental Economic Council

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produces a report on economy and environment. The 2018 report focuses on 1) Regulation of agricultural emissions of greenhouse gases; 2) Reducing CO_2 from passenger cars; and 3) Climate policy towards 2030. The report concludes that “Denmark must reduce emissions of greenhouse gases in non-ETS sectors by 39 per cent in 2030, compared to 2005. In 2015 agriculture and passenger cars accounted for respectively 31 and 21 per cent of total Danish emissions in non-ETS sectors” (Danish Economic Councils, 2018).

Ecolabeling, environmental certification and standards

Many companies in Denmark apply a strong environmental regulation through the European Eco Management and Audit Scheme, which set stricter environmental targets and standards for the company performance than International Standard Organisation (ISO 14001). The number of Danish companies adopting the ISO 14001 environmental management system was between 800 and 1 000. After a sharp peak in 2012, from 2013 to 2017 the yearly number increased gradually to reach its second highest level in 2017. An explanation for the fluctuation may be the impact of public support programmes that have promoted uptake of environmental management systems. Denmark does not have an Environmental Code but is attempting to make compliance with environmental legislation easier. Danish companies have also been successful in Environmental Technology Verification (ETV), a new tool to help innovative environmental technologies reach the market. Of the 28 verified technologies, eight are from Danish companies or 28.6% of all verified technologies (European Commission, 2018b). One reason why Denmark has a lower frequency of certifications could be the high share of products linked to agricultural production, where producers have been more resistant to obtain environmental standards and use food related eco-labelling, e.g. Danish organic label, and EU organic label which also has an impact on the farmers. The Danish organic label – the ‘Q’ logo – is an inspection label and shows that the latest preparation of the product has taken place in a Danish company inspected by the public authorities. The logo can be seen on both foods that originate from Danish organic farms and on imported foods that are processed, packed or labelled in Denmark. Denmark was the first country in the world that implemented a state control for organics in 1987. A strong standard is the Nordic Swan Ecolabel (www.nordic-ecolabel.org) which sets strict environmental requirements in all relevant phases of a product's life cycle; sets strict requirements for chemicals used in ecolabel led products; tightens requirements for goods and services continuously to create sustainable development; and certifies and verifies that all requirements are met before a product is approved. It is possible to acquire the Nordic Swan Ecolabel certification within 60 different product groups counting more than 200 different product types, including buildings.

Green taxation and environmentally harmful subsidies

The Commission has repeatedly stressed in the European Semester that taxation on pollution and taxation to combat climate change in Denmark is higher than elsewhere in Europe. However, the Commission has also pointed out that previous increases in the duty on emissions of nitrogen oxides are being rolled back. One of the most effective environmental taxes in the country is the pesticide tax, which has helped reduce the load of pesticides on the environment and human health by 40% between 2011 and 2016. Another environmentally beneficial tax is the animal feed mineral-phosphorus tax, which has helped reduce the consumption of mineral phosphate in animal feeds by 15% since 2005. However, the tax on phosphorus might have been environmentally and economically more effective if it applied to all sources, including mineral fertilisers. Meanwhile, fossil fuel subsidies fell in the past decade, thanks to the phasing out of indirect tax subsidy for diesel, which has a reduced energy duty compared to petrol. In 2016, fossil fuel subsidies, essentially the the reduced energy duty on diesel, amounted to EUR 1.2 billion. However, little progress has been made on reducing the ‘diesel differential’ (the difference in the price of diesel versus petrol) since 2005. In 2016, there was still a 46% gap between petrol and diesel tax rates, one of the highest diesel differentials in the EU. However, it should be noted that a compensatory fee or countervailing charge for certain diesel vehicles is applied. The tax treatment of company cars is not cause for concern in Denmark. New tax rules for company cars were introduced in 2018. The most significant of these

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increased annual road tax, cut taxes on electric cars. Denmark imposes CO_2-based motor vehicle taxes. The annual circulation tax (also known as the green owners' tax) is based on the car's average fuel consumption per kilometre. Biogas-and natural gas-powered vehicles have the same tax treatment as diesel cars, while petrol cars pay more on average. Incentives to purchase cars with lower CO_2 emissions were common in 2016. Some of these incentives were linked to annual circulation taxes, road tolls, congestion zones or low-emission zone charges. Other incentives were related to the acquisition of cars or use of public infrastructure. Denmark has adjusted an agreement on future tax conditions for electric cars, plug-in hybrid cars and fuel-cell cars by more slowly phasing in taxes on electric, plug-in hybrid and hydrogen cars.

SMEs and resource efficiency

Danish SMEs provide about 65% of the country's employment (compared to the EU average of about 67%). They account for nearly 62% of total value added (compared to the EU average of nearly 58%). In the Flash 426 Eurobarometer "SMEs, resource efficiency and green markets", it is shown that 51% of Denmark's Small and Medium-sized enterprises (SMEs) have invested up to 5% of their annual turnover in their resource efficiency actions (just above the EU28 average of 50%), 32% of them are currently offering green products and services (EU28 average 26%), 71% took measures to save energy (EU28 average 59%), 63% to minimise waste (EU28 average 60%), 52% to save water (EU28 average 44%), and 61% to save materials (EU28 average 54%). From a circular economy perspective, 39% took measures to recycle by reusing material or waste within the company (EU28 average 40%), 29% to design products that are easier to maintain, repair or reuse (EU28 average 22%) and 39% were able to sell their scrap material to another company (EU28 average 25%). According to the Flash 426 Eurobarometer, the resource efficiency actions undertaken allowed the reduction of production costs in a 41% of the Denmark's SMEs (EU28 average 45%). 27% of the SMEs in Denmark have one or more full time employee working in a green job at least some of the time (EU28 average 35%). Denmark has an average number of 1.6 full time green employees per SME (EU28 average 1.7).

Maintaining and restoring ecosystems and their services

Denmark has been recognised and awarded for its efforts to create liveable urban areas in which green infrastructure plays an important role. The Copenhagen municipality has adopted a policy to make trees a greater priority in the city between 2016 and 2025. In addition, the 2016 Nordic Council of Ministers gave a Nordic Built Cities Challenge award to a park in Copenhagen. The award recognised the park's innovative use of "blue-green infrastructure" to manage rainwater from cloudbursts in the Hans Tavsens Park in Copenhagen (more details presented in the Annex) Three Danish cities at the forefront of implementing sustainable urbanisation "Green Urban Denmark" is a publication jointly prepared by the Danish Energy Agency (DEA), the municipalities of Copenhagen, Aarhus and Sonderborg and the Danish Ministry of Housing, Urban and Rural Affairs. It highlights how Copenhagen, Aarhus and Sonderborg have developed and implemented green urbanisation and new sustainable energy initiatives in order to become carbon neutral cities with green profiles, which also boost green growth businesses. The green initiatives range from: extensive retrofitting of buildings; re-organisation of energy supply; radical changes in transport patterns to; environmental and climate change awareness campaigns. All of which have the goal to encourage citizens to reduce their energy consumption and increase energy renovation of private homes.

Green infrastructure

In May 2016 a political agreement on a Danish Nature Programme was adopted. The programme focuses on natural forests and allocates new areas to natural forests adding up to 25,000 hectares. The programme also establishes means for local projects and new interconnected nature areas for the benefit of threatened species. According to the programme, nature areas close to cities should be developed and opportunities for the population to enjoy nature through outdoor activities will be promoted. The programme attaches great priority to stimulate farmers to manage and protect nature though incentives such as subsidies for hedgerows and possibilities to redistribute of land in order to

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protect vulnerable nature areas and better use non-vulnerable areas. The programme introduces a revision of the regulatory framework for nature protection in order to create a more efficient and less bureaucratic administration. An innovation is a “Green Map” of Denmark which will provide both a strategic framework for nature policy and will function as an actual map for planning purposes. It will contribute to targeting ongoing and new initiatives with the greatest impact in terms of ecosystem services. By 2017, municipalities designated areas of the map, based on a common base map and common criteria. They are included in municipal plans for the first time in 2017 and gradually refined and implemented European Union, Green Infrastructure—Enhancing Europe’s Natural Capital, COM/2013/024936Ministry of Environment, Biodiversity -the building block of life.Benefits of green infrastructure for Denmark are illustrated by hedgerow planting. Hedgerows are natural features acting as wildlife corridors or stepping stones. Hedgerow planting reduces soil erosion through windbreaks which also provide habitats for various species. Under the Danish Rural Development Programme 2007-2013, farmers could ask for reimbursement of 40–60% of the cost for establishing 1–7 rowed hedges or woodlots smaller than 0.5 ha. As a follow up, a national support scheme is under development to establish more shelterbelts and biotope improving plantations. Besides the subsidy, the success of the hedgerow planting scheme has been attributed to farmers’ participation, good products and governmental action with a windbreak law that has been revised multiple times.

The Danish National Energy Policy Approach

Denmark’s long-term commitment to creating a green sustainable society is historically grounded in an early green vision which is closely linked to the decentralised governance system of Denmark. The Danish green transition is partly driven by national policy, but to a major extent also by visionary local authorities and citizens. Several Danish regions and municipalities have adopted their own ambitious climate and energy targets that also respond to the Danish National Energy Policy Approach of having 100% renewable energy in the energy and transport sector by 2050. As an example, utility companies are often owned by the municipalities and the local governance levels are to a large extent responsible for the detailed implementation of national policies through regional and municipal plans for urban and industrial development, district heat planning, location of power plants etc. The local governance level also plays a key role in enforcement e.g. of Danish building codes. In Denmark, as in most Organisation For Economic Co-Operation And Development (OECD)-countries, up to 40% of the total energy consumption is consumed in buildings. The energy performance of new buildings has since 1961 been regulated in the Danish building code, which covers energy for heating, cooling, ventilation, domestic hot water and lighting. The building code has been further tightened in the Energy Agreement of 2012, which also contains a number of initiatives aimed at reducing the energy consumption of existing buildings, including government subsidies for investments in energy conservation, an energy savings package for rented housing, and a new strategy for energy retrofitting of existing buildings. Today, the heat demand of new buildings is only about 25% of what it was before 1977, which is a result of a long-term commitment towards reducing the total energy consumption.

Financing greener cities

Denmark participates in the European Urban Development Network (UDN). This network includes more than 500 cities across the EU that are responsible for implementing integrated actions based on sustainable urban development strategies financed by the European Regional Development Fund (ERDF) in the 2014-2020 period. One of the UDN initiatives supported by the ERDF is Urban Innovative Actions (UIA). UIAs are a way to test new and unproven solutions to address urban challenges. The total ERDF budget for UIAs is EUR 372 million for 2014-2020. One of the UIA projects is called TUPPAC (Transforming Urban Planning Providing Autonomous Collective mobility). TUPPAC will receive EUR 3.4 million in funding, and is taking place in Albertslund in the suburbs of Copenhagen. The TUPPAC project will address the ‘first-and-last-mile’challenge, the name given to the problem of public transport rarely stopping directly in front of the passenger’s destination (whether that destination is work, home or a shop). The TUPPAC project will address this

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challenge via LOOP City —a collaboration between 10 municipalities on the outskirts of Copenhagen. In the years 2018-2024 a new light-rail system with 29 new stations will be built in LOOP City. Its goal is to encourage passengers to make use of public transport focusing on the physical environment and station proximity. The project will address future challenges of urban transport related to the introduction of driverless technology. Driverless technology is developing fast and will disrupt urban mobility in the coming decades. But it also raises questions such as: how can autonomous vehicles be an integrated part of public transportation and how will they affect urban planning? The TUPPAC project will make it easier for completely new types of innovative mobility services to appear. It will achieve this by addressing the ‘first-and-last-mile’ challenge in proximity to the new light-rail stations being built.

Participation in EU urban initiatives and networks

Danish municipalities are generally involved in EU initiatives on environmental protection and climate change. Four Danish cities, communities and regions are involved in the URBACT initiative to support sustainable urban development. They are involved in 10 of URBACT’s thematic networks. Several Horizon 2020 network projects have also contributed to the sustainability of Danish cities. The CIVITAS project includes three municipalities representing Denmark in a common effort to achieve cleaner and better transport in cities. Danish cities are also actively involved in initiatives such as Eurocities and the EU Covenant of Mayors. 37 Danish cities are involved with the EU Covenant of Mayors under the coordination of the central Denmark region, the KKR Zealand and Region Zealand. As of May 2018, Frederikshavn, Helsingør, Norddjurs, Ringkøbing-Skjern, Ringsted, Slagelse,Solrød,Sønderborg and Vordingborghave already submitted their 2020 action plans. The results of these action plans are now being monitored. Another 6 cities have at least presented their climate action plan and commitments for 2020 or 2030. In 2017, 12.7% of the Danish population living in cities considered that their residential area was affected by pollution, grime or other environmental problems. This is an increase from 2015 and 2016 when 10.0% of the Danish population living in cities were of this view. However, these figures are significantly lower than the EU-28 levels (20% in 2017, 18.9% in 2016 and 19.2% in 2015), and similar to the results seen in Sweden and Finland.

Nature and cities

More than 46% of the Natura 2000 network in Denmark is within functional urban areas, well above the EU average of 15%. The budget for agri-environmental-climate measures represents 22.5% of the total EAFRD budget -of the approved RDP and, since Denmark does not propose to increase the allocation for agri-environment-climate measure, the relative contribution will therefore significantly decline, although there are other measures that contribute to restoring, preserving and enhancing ecosystems related to agriculture and forestry, as well as additional funds allocated to reducing ammonia emissions. Denmark does not activate the measure on compensation for restrictions emanating from implementation of Natura 2000 in the RDP. Biodiversity financing in DK RDP is problematic since Denmark takes an "island" approach that does not consider areas outside Natura 2000, although these directly contribute to the objectives of Natura 2000, as well as the EU Biodiversity Strategy 2020. Denmark is committed to introducing measures to promote biodiversity in intensive agricultural areas. The RDP includes measures for pasture management in high-nature value and Natura 2000 areas, as well as a measure for organic farming conversion and maintenance. However, the main focus of funding is not on biodiversity, but rather on tackling pollution. After the modification, the RDP is going to be one of the main instruments for voluntary measures on constructed mini-wetlands, to tackle nitrates pollution after the abolition of obligatory measures and the introduction of a new agricultural package. With regard to the integration of environmental concerns into the Common Agricultural Policy (CAP), the two key areas for Denmark (as for all Member States) are, first, using Rural Development funds to pay for environmental land management and other environmental measures, while avoiding financing measures which could damage the environment; and secondly, ensuring an effective implementation of the first pillar of the CAP with

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regard to cross compliance and 1st pillar 'greening'. 30% of direct payment envelope is allocated to greening practices beneficial for the environment. An environmentally ambitious implementation of 1st pillar greening would clearly help to improve the environmental situation in areas not covered by rural development, including intensive agricultural areas, and if appropriate Denmark could review its implementation of this.

Traffic congestion and urban mobility

The total number of road vehicles in Denmark reached 2.8 million in 2015, increasing the rate of vehicles per 1000 habitants from 494 in 2014 to 501 in 2015. This increase has resulted in more hours spent annually in road congestion by the average driver, from 21.5 hours in 2014 to 22.1 hours in 2016. Denmark is far below the UK, which is the EU's worst performer on this measure at 45.1 hours. Road traffic intensity per unit of GDP in Denmark in 2014 was 248 vehicle kilometres per 1000 USD, which is close tothe OECD Europe average of 254 vehicle kilometres per 1000 USD. On urban mobility, in 2016 around 65% of Danish employees commuted more than 5 km to work. Private vehicles are the most frequently used mode of transport in Denmark, accounting for 60% of all commuter trips in 2009. However, bicycles made up a remarkable share, accounting for more than 20% of all trips. Public transport is also a major contributor, providing transport to 13% of the commuters. The modal split of passenger transport in 2015 shows that passenger cars accounted for 80.8% of inland passenger transport in Denmark (EU-28 83.4%). Buses and trolley buses accounted for around 9.9% (EU-28 9.1%) and trains for 9.3% (EU-28 7.6%).

Green public procurement (GPP)

A National Strategy on GPP is in force through the government strategy on Intelligent Public Procurement. Denmark has adopted the indicative political target of 50% of GPP as referred to in the GPP communication. Denmark has a well-functioning procurement system that is quite advanced in its strategic dimension, as it includes green, SME, social and to lesser extent innovation criteria. Procurement is conducted primarily at the local level, whereas the central government and the regions have a lesser share of procurement. GPP criteria are developed at the national level. Mandatory rules on GPP have been drawn up for purchases of wood and wood-based products; energy-using products; and road transport vehicles. The Danish government recommends that EU GPP criteria be used for the product groups where there is no national guidance. A national task force was launched in 2016 with the aim of helping public institutions (municipalities) to implement GPP. The national task force is supplementing the Partnership for GPP and a Forum on Sustainable Purchasing. To help procurers assess the total cost of ownership, specific tools have been developed in Denmark for 13 different product groups. These product groups are computers, computer displays, multi-function devices, servers, storage devices, projectors, large network equipment, small network equipment, UPS, add-on bidets, lighting, self-service machines and fridges and freezers. More tools are developed as a part of the government's Strategy for circular economy. The Danish government conducted a national-level investigation of GPP in 2013. The report covered nine of the product areas that are subject to the 50% target. It published a report on this investigation in 2016. The report finds that in 24% of the tenders covered all relevant green criteria were applied, and in 71% of the tenders one or more criteria were applied. A separate study on GPP by the European Parliament shows that Denmark is amongst the frontrunners in the EU on the implementation of its GPP national action plan.Since 2006 Denmark has a cooperation in public green procurement called ''Partnerskab for Offentlige Grønne Indkøb''. Membership is voluntary and for free. There is a Nordic co-operation (www.norden.org) under the initiative ''Green Growth Projects'' called ''Working together on green procurement in the public sector''. The main objective of this project is to strengthen green growth in the Nordiountries through a common approach to GPP - both in terms of policy development and on a more practical level (Nordic Council of Ministers, n.d.)

Adaptability, reform dynamics and innovation (eGovernment)

On digital public services, Denmark performs very well. The country is a frontrunner in the delivery of digital public services among EU countries with a score of 73.2/100 based on Europe's

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Digital Progress Report 2017, higher than the EU28 average (57.5/100). In the DESI Report 2018, Denmark had a score of 73 out of 100 on digital public services, higher than the EU average. In terms of open data, Denmark continued to make considerable progress over the last year (after launching a new platform). Thanks to a high score in their completeness of online services (94 out of 100), Denmark provides a good and user-friendly framework for eGovernment service for its citizens.

1.2. Green practices for maintenance of sustainable ecosystems in Denmark

Eco-innovations

Minimising food waste through vacuum-drying

The project “Waste Taste” addresses how primary fruit, vegetable, and berry producers can use vacuum-drying to avoid or reduce their food waste. This is done by converting the waste into valuable food ingredients and new products via an energy-efficient vacuum-drying technique. This results in great preservation of both the flavour compounds and the health beneficial substances in the raw product. Vacuum-drying is up to ten times more energy efficient than freeze-drying; hence, it is more cost-effective and more environmentally friendly. In total, primary producers in the fruit and vegetable production sectors in Denmark waste approximately 110,000 tonnes of edible food a year.

MATChE is a programme carried out by Technical University of Denmark in order to support Danish industry to increase its competitiveness, growth and job creation by demonstrating how to engage in an effective transition towards Circular Economy, using a readiness assessment and strategic driver identification tool. By enabling an effective transition of Danish industry towards circular economy, it is expected that a long-term systemic and sustainable enhancement of the Danish economy and society will take place, with value maximisation and increased resource productivity. The primary customer of the project is the Danish manufacturing industry, including their upstream and downstream value chains, across numerous sectors. MATChE uses a cross-sectorial approach, which enables for exponential knowledge enhancement and experience sharing among a large variety of companies.

Internet link: www.matche.dk

60 council flats to be built in Lisbjerg near Aarhus, Denmark, according to circular economy principles.

Once the flats are no longer fit for living anymore, 90 percent of the building materials can be recycled without losing value, e.g. a window from the building can be used as a window in another house. The project, known as Circle House, has received nearly EUR 940.000 in funding from MUDP. Today the construction industry accounts for an estimated 30% of the total amount of waste produced in Denmark. While the Danish construction industry has a high rate of recycling, the waste often is recycled into materials of low quality.

Internet links: Danish Environmental Protection Agency (Danish):

http://mst.dk/service/nyheder/nyhedsarkiv/2017/nov/nyt-projekt-skaber-60-nye-huse-med-materialer-som-kan-genbruges-i-fremtiden/

https://stateofgreen.com/en/profiles/state-of-green/news/60-homes-built-from-reusable-materials#/.Wh5a4PZoSFE.linkedin

Re-Match

Stadiums and sports arenas throughout the world are increasingly using artificial turf and after it is worn-out, 8-10 years, a large amount of artificial turf is sent to landfill. As the first and only in the world, Re-Match has the technology to separate 99% of worn-out artificial turf into raw components, which then can be recycled and manufactured into new artificial turf. Re-Match also offers cut & roll and handling, including transport of the old turf and sale of the finished clean products to be used in other products. Re-Match has all required permits, notifications, and authorisations in place, including permits for transportation of used turf across borders, making disposal of artificial turf very easy for owners of the used turf. Re-Match has obtained the ETV Certification.

Internet link: http://re-match.dk

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LEGO® planed to launch the first sustainable Lego bricks in 2018. The new sustainable LEGO elements are made from plant-based polyethylene made from ethanol produced from sugarcane. The sugarcane used in the production is sourced sustainably in accordance with guidance from the Bioplastic Feedstock Alliance (BFA) and is certified following global standards for responsibly sourced sugarcane. The plant-based plastic is technically identical to those produced using conventional plastic. The first bricks to be produced of the new material are, suitably, botanical elements such as leaves, bushes and trees.

Internet link: https://www.lego.com/en-us/aboutus/news-room/2018/march/pfp

The DreamWind project – How to recycle glass fibre from used wind turbine blades

The end-of-use and end-of-life solutions for wind turbine blades is currently that they are mostly crushed and put on landfill. The issue is becoming more and more urgent as many early erected wind turbines are closing into their end date. There are also broken blades that need to be waste managed. The objective of the project is to develop a chemical substance which makes it possible to separate composite materials from each other. The idea is that after it has been cleaned the glass can be reused in new fibreglass components and structures, e.g. wind turbines, aircraft or cars. Besides the economic benefits for the wind turbine industry, this new technology can also reduce carbon dioxide emission by lessen the need for producing new fiberglass.

Links: http://innovationsfonden.dk/en/node/789

https://stateofgreen.com/en/profiles/state-of-green/news/recyclable-wind-turbineblades

Vigga – circular subscription of baby clothes

One of the biggest issues for parents is that babies grow out of their cloths quickly. It’s both expensive and a waste of resources. Vigga offers a circular subscription model for baby cloth. The baby clothes are made from organic fabrics and once the baby has grown out of the clothes they are returned to Vigga. There the clothes are dry cleaned in an environmentally friendly way and made ready for another baby

Link: http://www.vigga.us/in-english/

Sashimi Royal / Nordic Aquafarms – sustainable fish production

Sashimi Royal will create a land-based sustainable production of fish in 2016. Production method includes from fingerlings to harvest of fish is based on RAS systems (land-based recirculation systems) will low water usage, very low discharge levels and no risk of fish escape. The facilities will include robust water treatment systems that minimise the risk of intake or spreading of disease. The production will not be exposed to the growing problem of sea lice. The facility will also harness all waste streams to develop value-added products. Nordic Aquafarms is majority shareholder in Sashimi Royal.

Link: www.sashimiroyal.com; www.nordicaquafarms.com

Amminex Emissions Technology – new standard for NOx reduction

The company’s unique NOx reduction technology is based on a system for ammonia storage and delivery, known as ASDS™. The system reductant is ammonia bound in a solid, together called AdAmmine™, to dramatically reduce the emissions of toxic NOx gasses from diesel exhaust. - **Link:** www.amminex.net - info@amminex.com

Carlsberg Circular Community - Partnering to eliminate the concept of waste

Carlsberg Circular Community is a partnership between key companies in the beverage industry: cans, coating, paperboard, fibre based bottles, PET containers, glass packaging and also in PR & communication. The objective of the partnership is to create new ways of designing and producing packaging material to eliminate waste and optimise the materials in such a way that they can be used for high-quality reuse and recycling. An example of this partnership is the development of the ’GreenFiberBottle’ that is made out of woodfiber that is 100% biodegradable and bio-based, hence generating zero waste.

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Link:http://www.carlsberggroup.com/media/PressKits/CarlsbergCircularCommunity/Pages/CarlsbergCircularCommunity.aspx - Jim Daniell (Director, International Media Relations), jim.daniell@carlsberg.com

Recycling building materials

The project Genbyg Skive (Rebuild Skive), by Skive Municipality, is about demolishing houses and recycling building materials for new purposes, such as construction of new houses and by that job creation in the local area. Thanks to this project the municipality has gained expertise in the field and has received international attention and has been mentioned as a good example and a pioneer project in an international report from the Ellen MacArthur Foundation (Ellen MacArthur Foundation, 2015a). The ambition is to make Skive Municipality the most well-known area in Denmark in relation to the reclaiming industry and with the most know-how within the industry of reusing old building materials. The project was funded by Central Region Denmark by DKK 1.4 mill. and Skive Municipality

Links:www.energibyenskive.dk/en/archive/rethink-business; www.energibyenskive.dk/en/archive/rethink-business/skive-municipality-asfrontrunner-in-recycling-building-materials/

Fossil free island – Samsø Municipality

The municipality has decided in 2011 that the island should be independent of fossil fuels such as oil, gas and coal in 2030. Samso Energy Academy has put forward a new masterplan for fossil free island and sets the targets for 2020 and 2030. This work requires focus on ‘next practice’ as well as ‘best practice’. The island is already 100% selfsufficient on renewable energy.

Links:http://energiakademiet.dk/en/fossilfri-o/;

Applicable models in waste management field in Denmark

Heat pumps and new business models

Best Green finances, installs and runs heat pumps. The company offers subscriptions with a fixed price per heating unit when customers switch from oil or gas to heat pump. That removes uncertainty for customers and the unknown factor of overall running costs when using heat pumps for heating. And society benefits by better utilisation of wind energy and CO_2 savings of 100%. A heat subscription will mean a saving of 10- 25% on costs excluding initial investment for enterprises and local authorities.

New products made of recycled raw materials

More and more of IKEA's products are made of recycled and recycable raw materials. For example, IKEA has designed kitchen elements made of recycled plastic bottles and wood waste, without having to compromise on either quality or design, and without making the product more expensive. Using recycled materials helps cut production costs, but does not mean having to lower standards for content of harmful substances or durability. IKEA has also focused on internal waste management in its stores, turning a 7-figured overhead into revenue totalling around DKK 800,000 in its Danish stores.

Electronic products can be used again and again

It takes 442 kg of resources to produce a new laptop computer. Many consumers replace electronic products after 3-4 years – way before they are worn out. Tier1Asset buys PCs, tablets and smartphones. It deletes data, cleans, upgrades and sells the products again with a new guarantee. By doing so, it doubles the product's lifetime, reduces impact on the environment and at the same time is a sound profit.

Herning Vand Herning

Vand's new "struvite plant" benefits the environment, saves on maintenance and provides a totally new form of revenue in the form of phosphor production. The struvite plant extracts phosphor from waste water to the benefit of the local aquatic environment, and the sale of phosphor provides a revenue stream to the benefit of Herning Vand. The lower levels of phosphor in purified waste water

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also mean a significant saving on the maintenance of pipes and pumps at the sewage plant. The partnership running the struvite plant believes that there is potential for between 30-40 new plants nationwide. The export potential is deemed to be worth DKK 1.6 billion over a ten-year period.

From fertiliser to valuable protein

Arla Foods has developed high-value products from whey since the 80s. Whey is a by-product from the production of cheese, and used to be used as animal feed. 5 million tonnes whey from home and abroad are now converted into such products as dietary supplements, infant formula milk and ingredients such as carbohydrates, proteins and minerals used in the food sector and medicine industry

Building with used materials

The walls of Copenhagen Towers should originally have been clad with glass and aluminium. But instead the Lendager Group used heartwood from old windows as an innovative form of panelling. The acoustic ceilings are made of recycled plastic bottles converted into a grey felt in a waffle pattern designed to absorb sound. Discarded carbon fibre sails from America’s Cup racing yachts have been cut and used for covering elevator towers instead of glass, a more attractive, interesting and eco-friendly result. Reused and recycled materials have overall reduced the energy need for material production by two thirds. And the actual building has not been more expensive than if virgin materials had been used.

From waste to product

The enterprise convert transforms waste from industrial production into products. Examples include textiles or wood waste which can be broken down to fibres of granules bound together by thermoplastic materials. The material is then formed into two mats that can be paper thin or as thick as insulation mats. The mats can be used for many purposes, including as insulation or for furniture, when they are pressed into the shape of a chair, for example. The concept is that the enterprise generating the waste can take it back as a product.

1.3. Applicable models for maintenance of sustainable ecosystems and improvement of the soil, air and water in Denmark

Soils

In Denmark, there is a long tradition of solving environmental problems relating to soil and groundwater contamination. The first Danish law on soil contamination dates all the way back to 1983, making it one of the first of its kind in the world. In the course of the last three decades, Danish companies and public authorities have developed a unique level of expertise regarding soil and groundwater remediation. This is partly due to the strict legislative requirements imposed by the Danish authorities, which constantly force companies to make improvements, and partly due to the promotion of strong collaboration between the public authorities, knowledge institutions, and the private sector in Denmark. Since the beginning of the 1980s, this effort has led to the identification of more than 30,000 Danish properties and sites which are ‘contaminated’ or ‘potentially contaminated’. Besides this, the historical mapping of a specific site can be initiated by a private building developer in connection with a new building project. Based on the mapping, the next step is to initiate preliminary investigations in order to confirm or reject the presence of any contamination in the soil or groundwater. The preliminary investigations financed by the public authorities are most often undertaken in collaboration with a private consultancy. All data collected in this phase is added to a database, and the site in question is categorised as a ‘stage one knowledge level’ site. If the preliminary investigations show that the site may pose a risk to human health or the groundwater, the third step of the value chain is to conduct in-depth investigations of the soil in order to determine the extent of the contamination, assess the risk that it poses to human health and the environment, and decide on the right remediation measure. When this procedure is completed, the site in question is categorised as a ‘stage two knowledge level’ site.

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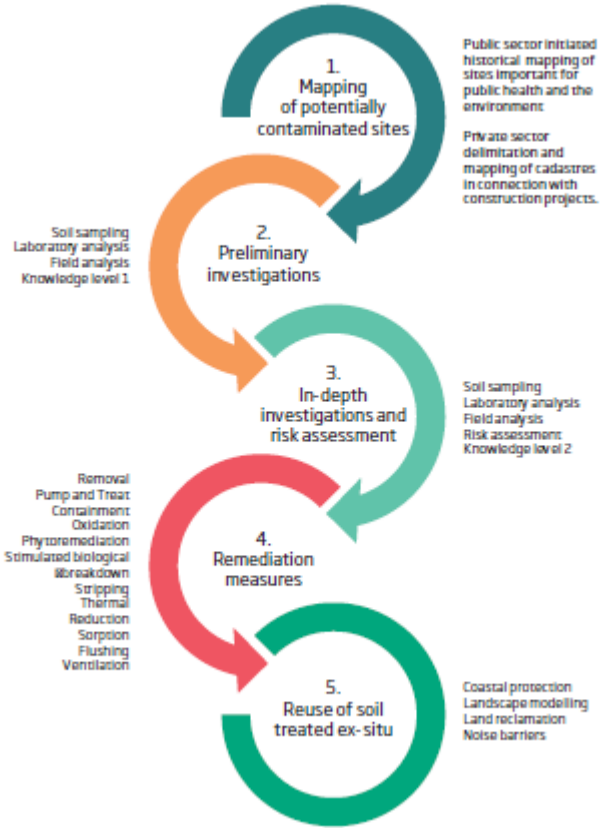

Figure 13. A general Danish value chain for soil and groundwater remediation; Source: Danish Soil Partnership, DSP

Fourthly, depending on the results of these investigations, it might be necessary to set an actual remediation project in motion. This can take place either at the contaminated site (in-situ) or by excavating the contaminated soil and transporting it for remediation at an external facility (ex-situ). If, on the one hand, the remediation process is being publicly financed, high-tech in-situ solutions are often preferred. If, on the other hand, the process is being financed by a private building developer, the solution is very often to excavate the soil and transport it for ex-situ treatment as this saves time and money in the building process. Lastly, in the case of ex-situ soil treatment, the fifth step of the value chain is the reuse of the purified soil, which can be used for instance for coastal protection, landscape modelling, land reclamation, or as noise barriers along roads and motorways. Groundwater resources receive special attention in Denmark, as nearly all of the drinking water supply throughout the country is pumped from groundwater resources. All data from the ongoing mapping of contaminated and potentially contaminated sites in Denmark as well as the many site investigations, test and pilot projects, and actual remediation projects, is uploaded into a central, open database called “DKJord” (DK Soil).

Remediation of chlorinated solvents in clay soils

Remediation of clayey soils contaminated with chlorinated solvents presents a big challenge which very few methods so far have been able to meet. One of the few successful methods is called EK-BIO, which has been developed by the private consulting engineering company NIRAS A/S, and the specialist American company Geosyntec Consultants in collaboration with the Capital Region of Denmark. In 2011, the first field tests of the method were carried out in the Danish town of Skuldelev with such success that it was decided to use the method in a full-scale remediation project at the site. The fullscale application was initiated in December 2012 and is expected to be in operation for three

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to five years. The method is based on electrokinetically enhanced bioremediation. Since the first successful application of the method in Denmark, the EK-BIO method has achieved widespread recognition by experts abroad, and has won a prize for best 'green innovation' in the United States. Furthermore, EK-BIO is currently being tested in the United States at the Jacksonville Naval Air Station. If the results from this test project are as promising as they were in the Danish project, the method will be used commercially to remediate contaminated clayey sites owned by the United States Department of Defense.

Link: www.niras.dk; www.geosyntec.eu/projects/electrokineticenhanced-bioremediation-of-chlorinated-solvents-in-denmark

Cleaning up contamination from old petrol stations

All over the world, old petrol stations constitute one of the major sources of soil contamination. 20 years ago, the same was true in Denmark. Following the energy crisis in the late 1970s, a process of reorganisation and centralisation formed the Danish market for petrol stations. By 1990, 8,000 of the country's petrol stations had closed down leaving behind sites contaminated with petrol and other oil-based substances. In 1992, this led the major companies operating within the Danish oil sector to sign a voluntary agreement with the authorities to clean up the contaminated sites, and two years later the 'Danish Oil Sector's Environmental Pool' became a reality. The companies involved pay a monthly fee based on their respective sales of petrol. This adds up to an annual amount of around EUR 2.7 million, which has been used every year since then to clean up the contaminated sites. By the beginning of 2012, there were only 71 contaminated petrol station sites left in all of Denmark, and the last of these were cleaned up by 2015. The large number of remediation projects financed by the Danish Oil Sector's Environmental Pool since the beginning of the 1990s has helped develop the systematic procedure and efficiency which characterise Danish remediation projects today.

www.eof.dk <http://www.eof.dk>

Prevention

Over many years, Denmark has developed procedures and methods for preventing the spread of new soil contamination, which means that soil and groundwater remediation in Denmark truly is a thing of the past. The hard-won lessons learned in Denmark regarding prevention are embedded in the Danish solutions and consultancy services, which are exported all over the world.

Risk assessment

The tools and methodologies for assessing the health-related and environmental risks connected with contamination at specific sites are continuously being improved. One example is a collaboration project between the Capital Region of Denmark, Orbicon A/S, the Danish EPA, and the Technical University of Denmark to develop a common tool for the risk assessment and benchmarking of different contaminated sites in order to be able to prioritise which sites to remediate first. Similar projects are running in all of the country's five regions, which have an interest in improving risk assessment tools in order to optimise their efforts to prevent groundwater contamination and protect public health. Besides this, the risk assessment procedure is firmly anchored to educational activities based on the latest tools and knowledge. Each year, The Technical University of Denmark holds a continuing education course on risk assessment attend 40 people from the sector.

Water

Rainwater for washing machines and toilets cut water consumption by 40 %

Up to 10,000 households’ washing machines and toilets in the suburb Nye – near the city of Aarhus – will soon use rainwater instead of drinking water. This is estimated to cut water consumption by as much as 40 percent. Taking rainwater, which is collected in a specially built lake and cleaned it at the treatment plant by a special ultrafilter and ultraviolet disinfection system. Then, the water is sent out into the homes via a separate pipe system developed for this purpose. The solution will also work in case of droughts. When there is insufficient rainwater available, the water supply is supplemented with wastewater from drains, which is also treated at the treatment plant. The entire infrastructure to direct the purified rainwater out to the residents of Nye has already been

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established. The purification plant itself is ready by the end of 2020. In addition to handling everyday rainfall, the district also deals with a rising threat of extreme rainfall due to climate change. Roads and paths are constructed to function as waterways, which should reduce the need for larger sewage pipes or delay pools during heavy rain. By using roads, paths and green areas to direct the water where it does the least damage, thus, handling extreme rain intelligently. For example, roads direct the water to ball courts and parking lots designed to handle water in extreme quantities. Thereby, the solution combines water management with livability by using recreational spaces as flood protection.

Aarhus Rewater

Aarhus Rewater is to be a cutting-edge wastewater treatment plant and urban landmark

The plant, which will replace the existing Marselisborg wastewater treatment plant in 2028, will be a state-of-the-art treatment center and stand as a stunning landmark on the Aarhus harbour front. In just a few years, Marselisborg wastewater treatment plant will no longer have the capacity to purify the wastewater from the rapidly increasing population of the city of Aarhus. With little room available to expand the existing facility, Aarhus Rewater is to be built with a new location in the area. The development follows in the large footsteps of Marselisborg, often referenced as one of the “most advanced” wastewater treatment plants, generating a 50 percent energy (electricity and district heating) surplus, rendering water/wastewater services energy neutral for the entire Marselisborg area. Upon completion, Aarhus Rewater is expected to be the world’s most sustainable and innovative wastewater treatment plant, which, in addition to purifying wastewater, will produce surplus energy and utilise the resources in the wastewater to an extent not seen elsewhere. In the future, for example, it will be possible to produce nutrients, proteins, foods, chemicals and basic substances for the wastewater industry. Aarhus ReWater will be a recreational destination in the city, where locals and visitors can gather about the water and learn about its social value and great importance for our common future.

Air

Air pollution from stoves

Denmark has about 750 000 wood-burning stoves and about 45 000 boilers, which contribute significantly to air pollution with particles, poly-aromatic hydrocarbons (PAH), and dioxins. Testing certificates are necessary for wood-burning stoves and central heating boilers running on solid fuel that are sold, transferred or connected after 2008. The requirements for the quality and efficiency of such stoves and boilers were strengthened under a January 2015 statutory order. Throughout several heating seasons, the EPA has conducted nationwide information campaigns on cleaner wood burning, for example the most recent campaign "Quit Smoking for Wood Stoves”. In 2015, a scrapping scheme for old wood stoves (DKK 45 million) was launched. Households possessing an old wood stove from 1990 or before could apply for DKK 2 150 if they scrapped the old one. The scheme ended in 2016 when about 20 000 old wood stoves had been scrapped. Since 2008, the Danish Eco Innovation programme has invested more than DKK 20 million into analysis and demonstration of technologies to reduce pollution from wood stoves and boilers.

Traffic emissions

In compliance with the EU legislation, Denmark has introduced common standards, known as Euro norms, which define maximum allowed values for exhaust emissions from car engines. Other measures to reduce emissions from transport include green zones. Major Danish cities have established low-emission zones in which heavy-duty vehicles are obliged to have filters that reduce the emission of particulate matter. Driving without particle filters is not allowed in these zones. Road charging is not widely applied in Denmark except for heavy duty goods vehicles where the charge is time-based rather than distance-based. The latter may have to change under a recent proposal by the European Commission.

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PORTUGAL

2. Green practices in Portugal

Source: Eurostat

GDP
EUR 173 billion (1.2 % of EU-28 total in 2014)

Per person GDP
EUR 21 400 (in purchasing power standard)
(78 % of EU-28 average per person in 2014)

Use of materials
149 million tonnes DMC (2.2 % of EU-28 total in 2014)
14.3 tonnes DMC/person (109 % of EU-28 average per person in 2014)
Resource productivity 1.14 EUR/kg (57 % of EU-28 average in 2014)

Structure of the economy
Agriculture: 2.6 %
Industry: 22.4 %
Services: 75.0 % (2014 est.)

Surface area
92 200 square kilometres (2.1 % of total EU-28)

Population
10.4 million (2.0 % of EU-28 total)

2.1. Effective approaches and green measures for maintenance of sustainable ecosystems and improvement of the soil, air and water in Portugal

The Green Growth Commitment

As Portugal is undergoing a structural transformation of its economy, the main public policy challenge is the establishment of an efficient, low carbon and environmentally-friendly resilient economy. In order to answer the specific challenges of Portuguese society, namely not taking full advantage of the economic opportunities of the green economy, and the need to take action in face of climate change and deteriorating natural resources, the Portuguese Government launched the Green Growth Commitment (GGC) with the purpose of reorienting the country’s economic development. The preparation of the GGC was supported by the Green Growth Coalition (Governo de Portugal, 2014b) which combines the efforts of almost 100 organisations, representatives of the business, science and financial sectors, public bodies, foundations and nongovernmental organisations (NGOs). The GGC is a direct result of the vision and discussions within the Green Growth Coalition. Its aim is to “foster green economic growth in Portugal with a national impact and international visibility, stimulate green economic activities, promote the efficient use of resources and contribute to sustainability”.

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Figure 14. Green Growth at the centre of a new paradigm; Source: Commitment for Green Growth, 2014

The GGC sets 14 objectives (e.g. increase the reintroduction of waste materials into the economy to 68% in mass), supported by 111 measures spread across 10 priority sectors and six catalysers for change (e.g. financing instruments). By combining all these elements, the GGC can be understood as the Portuguese roadmap for a transition to a greener economy. However, it should be updated in order to accommodate emerging trends in EU policies.

Green Tax Reform

In February 2014, a special commission was appointed to propose a Green Tax Reform for Portugal. Throughout 2014, many parties from the public sector, industry and NGOs, among others, were consulted, and public discussions were held in order to receive as many inputs as possible. By the end of the year, the Law 82-D/2014 was published. It changed the tax system in several areas, namely energy, transportation, water, waste, land-use planning, forestry and biodiversity, and introduced a special tax on plastic bags and an incentive system for end-of-life vehicles. The Green Tax Reform aimed at five major objectives: to reduce external energy dependence, promote more sustainable production and consumption habits, promote resource efficiency, promote entrepreneurship and job creation and, finally, increase the diversification of tax sources under the strict principle of fiscal neutrality. It accomplishes this by increase the taxes on pollution and emissions and reducing taxes on income. Some of the most relevant measures under the Green Taxation reform include the EUR 0.10 levy on light plastic bags, the increase of landfill taxes to EUR 11 per tonne in 2020, carbon tax on economic sectors outside the scope of the EU Emissions Trading System (ETS) and several incentives for electric vehicles and LPG- and LNG-based vehicles. These measures are expected to have a lasting effect and promote the effective transition towards the circular economy. For instance, the media cite the Portuguese Environment Agency finding that the plastic bag levy has already led to a 95% consumption reduction.

Operational Programme for Sustainability and Efficient Use of Resources (PO SEUR)

PO SEUR, the Operational Programme for Sustainability and Efficient Use of Resources, established through an Execution Decision from the European Commission on 16 December 2014, is one of the 16 programmes created for the operationalisation of the Portugal 2020 Strategy, a partnership agreement established between Portugal and the European Commission that gathers the action of five European Structural and Investment Funds. In particular, PO SEUR aims to contribute to the objective of sustainable growth, addressing the challenges to the transition to a low-carbon economy based on a more efficient use of resources and the promotion of greater resilience to climate risks and catastrophes. Portugal is deeply committed to the structural transformation of its model of development, thus trying to create conditions for a greater cohesion and convergence within the European context. Pragmatically, this operational programme is also the main instrument through which the Portuguese Government finance the investments in several policy instruments, namely the

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National Strategy for Climate Change Adaptation (ENAAC), National Plan for Municipal Solid Waste (MSW) management (PERSU 2020), and the National Plan for Water Distribution and Sanitation (PENSAAR 2020), among others. Approved in late 2014, several applications for the PO SEUR were opened in 2015. This demonstrates the country's commitment to implementing the PO SEUR as soon as possible in order to reap the benefits (e.g. improved waste collection systems) before 2020, when most targets are assessed.

The Lisbon Strategy for 2010-2024

The Strategy includes green infrastructure activities, such as creating a network of green spaces and green corridors for recreational activities and for protecting, appreciating and promoting biodiversity and natural and cultural landscapes. The Master Development Plan for Lisbon aims to ensure the continuity and complementarity of natural and seminatural systems in the urban territory. The city also has a target to increase 20% of its biodiversity by 2020. A successful instance of green infrastructure is the Quinta da Granja Urban Park, a multifunctional park that embodies many different visions and caters to a variety of needs, with features such as flowerbeds, a playground, community gardens, woodland and the restored old palace. Also the Quinta do Pisão 37, a working farm and large public park developed on abandoned farmland. It attracts both locals and tourists for recreation. This strategy has increased the size and improved the quality and connectivity of green areas in Lisbon, thanks to cycle lanes, bicycle-friendly streets, ecological corridors and allotments. The green corridor networks and informal open areas such as allotments are accessible to urban residents, workers and tourists. Other benefits are: the positive impact on health of promoting active transport (walking/cycling), environmental impact gains, and additional income (and jobs) from an increased number of visitors. There is still room for improvement in implementing these measures.

Soil quality improvement

The percentage of artificial land in Portugal can be seen as a measure of the relative pressure on nature and biodiversity, and of the environmental pressure on people living in urbanised areas. A similar measure is population density. Contamination can severely reduce soil quality and threaten human health or the environment. A recent report of the European Commission estimated that potentially polluting activities have taken or are still taking place on approximately 2.8 million sites in the EU. At EU level, 650 000 of these sites have been registered in national or regional inventories. 65 500 contaminated sites already have been remediated. Portugal has registered 181 sites where potentially polluting activities have taken or are taking place, and already has remediated or applied aftercare measures on 83 sites.

Green cities

The Portuguese city of Torres Vedras was one of the two winners of the inaugural EU Green Leaf award in 2015. Torres Vedras took part with other Green Leaf cities in a TAIEX-EIR P2P workshop on waste management and the green economy in urban areas, held in Galway (Ireland) in February 2018. Moreover, it has to be highlighted that Lisbon has been selected as European Green Capital for 2020. Portuguese cities are also actively involved in initiatives such as Eurocities and the EU Covenant of Mayors. By June 2018, 140 cities and towns were signed up to the Covenant. These urban initiatives and networks should be welcomed and encouraged, as they contribute to a better urban environment. In 2017, 15.4 % of city residents considered their residential area to be affected by pollution or other environmental problems, down from 15.1 % in 2016. These figures are lower than the EU 28 levels (20 % in 2017, 18.9 % in 2016 and 19.2 % in 2015).

Private and public-private interractions

Portuguese SMEs continue to score in line with the EU-28 average as regards the environmental dimension of the Small Business Act. Less firms than in other countries are developing a distinct 'green' profile, generating more than half their turnover from green products and services. However, more benefit from public support measures for their production of green products. There are some sectors where the private-sector is particularly involved in innovation, such as the energy and the

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telecom sectors, but others where eco-innovation is particularly relevant, such as waste management, there is little improvement in recent years. Portuguese companies have limited ambition as regards further action to boost resource efficiency. Direct cost savings may have motivated past action, particularly during the credit crunch. If this trend is confirmed, Portugal will need to re-ignite its ambition to improve resource efficiency and make products and services more environmentally friendly.

2.2. Green practices for maintenance of sustainable ecosystems in Portugal

LOGOPLASTE-ECOVER

The company Ecover, together with Logoplaste Portugal, has created the first bottle made from recycled plastic, 10% of which is plastic waste recovered from the sea. Using existing fishing boats kitted out with clever new technology, Waste Free Oceans' “catch of the day” project enables European fishermen to earn money by collecting between two and eight tonnes of waste plastic per catch for cleaning and recycling. As part of a trial project, this waste has been sent to Closed Loop Recycling's plant where it was processed and turned into plastic, which was used by Logoplaste to make the new Ecover bottle. The product, aptly named “Ocean Bottle” represents an important step in increasing the awareness of the oceanic plastic pollution and the needed action towards preventing and recovering these materials.

http://www.logoplaste.com/news_art.php?id=bGFuZz1FTiZwPTE4Ng

http://uk.ecover.com/en/why-ecover/ecover-ocean-plastic-bottle/

Green boots

The company Green Boots began its operations in 2012, and its story is deeply rooted in the traditional footwear sector of central Portugal (Benedita). Based on a traditional boot model developed 58 years before, Green Boots combines natural and recycled materials, and uses artisanal equipment and craftsmanship to recreate traditional footwear models. The soles are made of tyre treads, the interiors are covered with a cork by-product (corticite) and the hides are treated with a vegetable-based tanning. The project also has a strong social network component, since it strongly encourages the interaction between elder craftsmen and women and the designers.

http://www.greenboots.pt/

Environmental education programme focusing on solid waste

This programme, implemented with the participation of the company ValorSul, has been initiated in Lures municipality with a population of about 200,000 people. Its purpose has been to inform young people about the importance of the recycling process in order to achieve change in their attitude toward nature and to provide initial information on the separate waste collection. The campaign focuses on the separate collection of the greatest possible number of packages in the yellow container. To learn about the importance of recycling, classes in schools are encouraged to compete for various vouchers, which are won by the class with the most kilograms collected waste in the yellow container. The efficiency of the programme is due to the fact that it is executed at local level, thereby close to the people, and in particular, to school children and through them - to their parents. This project shows high efficiency, as is performed by and for the local community and attracts everyone’s attention by encouraging responsible behaviour towards the environment Within the contests, part of the programme, teams from the participating schools submit projects related to solid waste treatment and reflecting the importance of separate collection of the packages of the used products.

Campaign for recycling of packaging waste (PW) of Sociedade Ponto Verde

Sociedade Ponto Verde (SPV) is a private nonprofit organisation, created in 1996, whose mission is to promote separate collection, utilisation and recycling of waste from packaging in Portugal through a system for integrated management branded as “Green dot”. The system provides a closed waste utilisation cycle resulting in production of new packaging, contributes to the increase of the useful life of materials and the preservation of environment. SPV funds the municipalities in Portugal

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to maintain bins for separate waste collection. Also, it provides the recycling of the separately collected waste (paper/cardboard, glass, plastics, wood, steel and aluminium); monitors the distribution of the packaging and guarantees its destination for recycling or energy recovery. SPV promotes the environmental awareness and education of consumers through campaigns in the media and provides support to municipalities by launching programmes to stimulate market development of recycled products and materials. The first campaign of SPV was launched in 1998 and had a very clear purpose - to inform packaging companies operating at this time in Portugal, about the new solution for managing of packaging. An year later, SPV proceeded to the next stage of the campaign, namely the start of active communication with consumers. The aim was to raise awareness on the importance of selective collection of packaging and to provide information on how to do this. Pretty soon the campaign gained the support and active participation of the population, which had been the prerequisite for the achievement of the objectives, set out by the European Union in the field of environmental protection.

“How much can we recycle for one hour?”

In 2012, “Green Dot” Association (SPV) has launched a campaign aiming to inform the Portuguese population about the impressive number of products recycled in Portugal per one hour only. In order to turn the numbers into something tangible, SPV has once again used a simple but effective form of communication, showing that the glass wastes that can be recycled in 1 hour are equal to the weight of 12 elephants, or that a four-storey-high bottle can be build with the recycled glass. The information that has been provided has been attractive, emotional, easy to understand and accessible through different communication channels. Thus, people have been able to realise the grandeur of the numbers, and at the same time SPV has underlined that everyone’s contribution makes a difference. The campaign challenges people in Portugal to ask themselves “How much can we recycle in one hour?” and achieved excellent results. In 2003, only 38% of the population did separate waste collection, while a survey in 2011 shows that 69% of the population is already separating packages.

2.3. Applicable models in waste management field in Portugal

Smart City - Intelligent Waste Management System

Cascais, Portugal

The smart waste management system implemented in the municipality of Cascais combines the use of underground waste containers with a technology of remote fill-level sensors. While underground waste containers reduce visual impacts and maximise the use of urban space, remote fill-level sensors installed in these containers enable to trigger and manage a smart collection when these are nearly full. The sensors read the level of waste in each bin and transmit the data to a central management platform, which then allows to determine when and how the collection vehicles should start their route. This management platform can be accessed remotely in any web browser. Installing underground waste containers and equipping them with remote fill-level sensors resulted in cost reductions for municipal waste services of Cascais, while simultaneouly improving the services.To achieve its objectives the project first proposed the installation of 465 underground rubbish bins grouped in 107 “ecological islands” (one bin for each type of recyclable material - cardboard, plastic, glass and other generic waste). These underground rubbish bins were estimated to increase the collection of recyclable material by 274% and the capacity to collect general waste by 40%. Further, the project promised the removal of 350 street rubbish bins and around 240 eco-points to generate more space for pedestrians. As a next step, installed underground waste containers have been equipped with remote fill-level sensors to not only increase waste disposal capacity and public space but also to guarantee smart and efficient waste collection.

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Underground rubbish bins [12]


Waste collection vehicles [13]

As first city in Portugal, Cascais set up its waste management system using data generating technologies, thus making the system one of the most advanced waste management systems in the country and also in the European territory. Additionally to the installation of sensors in the underground waste containers and the development of an online management platform also further features were included in the city’s waste management system. E.g. green residues, electronic waste, etc. are/is characterised and recorded at collection, thus enabling the establishment of a large data pool making smart management possible. Over time, such a large data pool allows for further improvement of services, e.g. a continuous optimisation of collection routes, optimisation of frequency and personal required in each route, reduction of paper work, etc. Further the city developed a mobile app through which citizens are able to report illegal or abandoned waste incidents and locations.

Main project benefits:

- Waste collection services improved.
- Optimised collection routes for drivers.
- Reduction of municipality costs for collection.
- Reduction of carbon emissions.

Awards:

2015: The project was honored with the "A Smart Project for Smart Cities" label under the category “Sustainability”. The "A Smart Project for Smart Cities" award recognises innovative projects under the field of urban development.

2014: The project was honored with the “Urban Waste Management Quality Service Award” given by the Regulator of Water and Waste Services.

“Fraldinhas" (“Little diapers")

The campaign “Little diapers” aims to promote a change of habits in families by promoting the use of cloth diapers, helping to reduce the volume of waste generated in accordance with the Plan for the prevention of urban waste in Portugal. Covering the territory of the entire country, the campaign includes the provision of sets of cloth diapers in maternity homes and in families expecting a child. Also, the campaign is supported by the providers of such diapers by offering a discounted price. The initiative is particularly important because this is a little known topic among families with children. By its implementation parents realise that diapers can be recycled, and this can greatly contribute to the development of an environmentally sound society. The campaign has played a prominent role and has achieved tangible results.

E-waste

According to the Portuguese Decree-Law 230/2004 of 10 December 2004 (Diary of The Republic, 2004), by e-waste is meant “an electrical and electronic equipment residue, including all components, subassemblies and consumables which are part of the equipment at the time of discarding”. In Portugal EU directives 2002/96/EC and 2002/95/EC concerning waste electrical and electronic equipment have been transposed by Decree 230/2004 dated December 10, 2004, which replaced Decree 20/2002, dated 20 January 2002. More recently, Decree-Law 67/2014 of 7 May transposed into national law Directive 2012/19/EU of the European Parliament and of the Council of 4 July 2012, revoking the previous decree-law. This Law comprising 49 articles and 9 annexes sets forth that the main operators in the process are: the producers, the register entity, the integrated waste management entity and the consumers. The register is mandatory for those involved with electrical

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and electronic equipment within the national territory and the ANREEE (National Association for the Registration of EEE) is responsible for assuring, organising and maintaining the mandatory register of producers of electrical and electronic equipment (Decree-law 230/2004 of 10 December, altered by Decree-law 132/2010 of 17 December) and batteries and accumulators (Decree-law 6/2009 of 6 January). In Portugal, there are two entities involved in e-waste management: Amb3E and ERP Portugal. Amb3E is a non-profit association that aims at organising and managing an integrated system to manage electronic waste. The ERP Portugal belongs to the European Recycling Platform (ERP) created in December 2002. The licenses were awarded in April 2006 by joint orders of the Ministry of Economy and Innovation and the Ministry of Environment and Territorial Planning (353/2006 and 354/2006). Currently Amb3E has 60 associated enterprises, of which 57 are founders, and more than 1.300 participating firms, and 86 collection points around the country (Amb3E, 2015). Among the main Amb3E initiatives to promote e-waste recycling are Ponto Electrão, Escola Electrão and Quartel Electrão. The purpose of Ponto Electrão is the collection of end-of-life electrical or electronic appliances in order to ensure that they are properly recycled. Currently there are 349 in Portugal. Escola Electrão is a partnership between Amb3E, the Ministry of Education and Science and the Portuguese Environment Agency to raise student, teacher, staff and parental awareness to the importance of recycling waste in general and end-of-life electrical and electronic equipment in particular. The campaign Quartel Electrão took place in 2011 and aimed to support the Portuguese Fire Corporations by raising awareness to e-waste related environmental issues. In 2015, 16.254 tons have been recovered in Portugal by ERP (ERP Portugal, 2015). Amb3E in turn has collected about 36.845 tons in Portugal in 2015. This includes about 320 tons recovered in the Azores and about 428 tons in Madeira (Amb3E, 2015). At the end of 2015, 1758 manufacturers, retailers own brand and importers of electronic and electrical equipment were registered in Portugal, which represents an increase of 4.6 percent compared to 2014 (ANREE, 2016). In terms of number of devices there was a decrease of 8.3 percent. In terms of equipment weight there was an increase of 6.9 percent. The per capita collection rate in Portugal was 4.4 kg in 2010 - an amount slightly higher than the 4kg per capita established by the European Directive. In 2011, that rate increased to 5.3 kg per capita but in 2012 decreased to 3.8 kg (Eurostat, 2016).

Organised waste market (MOR)

An important step in promoting reuse of waste or recovered material as a secondary raw material within the Portuguese economy was taken in 2006 with the creation of the organised waste market (MOR). The MOR is a voluntary system, which promotes exchange of information about waste materials available on the market and facilitates trading of these materials between economic entities. It is envisaged that all categories of waste can be traded on the MOR after being sent for recovery operations (OECD, 2011b). The 2009 regulations concerning the MOR established rules for transactions and their operators, as well as for monitoring of organised waste market management entities by the public administration. In 2011, the first integrated online platform has been established. MOR Online is an electronic platform bringing together sellers and buyers in total security, due to the nature of the products traded – industrial, household, construction, demolition and other types of waste. According to the Decree Law 73/2011, June 17th it will be also possible to trade sub products, recycled materials and toxic waste. This platform has been authorised by Agência Portuguesa do Ambiente. Waste producers can put up their waste for sale at MOR Online and guarantors and recyclers can buy it in a completely transparent process. MOR is financially self-sustaining, as there is a charge transaction and membership fees.

Fruta Feia

“Beautiful people eat Ugly Fruit”. This is the motto of the Portuguese initiative Fruta Feia (Ugly Fruit), which targets produce that is rejected in terms of calibre and general appearance. Those items are typically sent to other industries, to be used in juice manufacture and food canning, and in some cases are disposed. Ugly Fruit is a cooperative of producers that breaks with this modus operandi and tries to invert the normalisation of fruits and vegetables that are not related with health and safety

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issues. It addresses market inefficiency and attempts to invert consumption patterns. The fruits and vegetables are sold in 3- 4 kg and 6-8 kg boxes to end consumers, in prices that range from EUR 3.50 to EUR 7. Ugly Fruit currently has 800 final consumers (with 2000 signed up) and prevents the end disposal of 4 tonnes of waste per week.
http://frutafeia.pt/

2.4. Applicable models for maintenance of sustainable ecosystems and improvement of the soil, air and water in Portugal

Cleanbiomass

Cleanbiomass is a company operating in forestry activities and management of resources. Seeking to tackle an important challenge in terms of forest fire control, it has developed a tool specifically tailored to collect uncontrolled weeds and bushes that typically emerge after forest fires. The innovative feature is that unlike other similar technologies, the operation removes the vegetation cleanly by its roots and without disturbing the soil, thus allowing the use of the collected vegetation as biomass for energy recovery. According to the company, each tool allows a reduction in emissions of 6,000 tonnes of CO_2 by recovering the biomass, allowing 40 to 50 times more energy to be generated than is consumed by the entire process up to the delivery of the biomass at the energy recovery unit.
http://www.cleanbiomass.pt

Programme “Eco Schools” 4

The international educational programme in the field of environment and sustainable development “Eco Schools” has achieved great success in Portugal as its aim is to raise the awareness of students on sustainable development issues through classroom and community activities. Students can choose what they want to do, how to learn about the environment, and how to protect it. Furthermore, they are involved in the decision-making process on which activities to implement in their schools. In turn, the schools’ administrations promote the implementation of programme activities. The programme recognises and rewards students’ work to improve the school’s performance in the field of environmental management. Also, it stimulates the creation of habits for active participation by the inclusion of children and young people in decision-making. The need to change attitudes and to promote sustainable behaviour in everyday life is motivated. Good practices are presented actively, thus strengthening networking at national and international level. This, in turn, contributes to the creation of local partnerships and synergies. The “Eco Schools” programme develops a diverse set of initiatives, such as:

- Valorfito challenge: it aims to motivate children and young people to research on existing agricultural practices in the region as well as to draw attention to the importance of proper handling of packages of some of the products used in agriculture, more particularly phytochemicals
- Litter less campaign: it challenges young people to observe, interpret, report and find more sustainable solutions to the problem of waste
- Sailing for oil: it aims to encourage the habit of valuing used cooking oil
- Cartridge collection: it aims to encourage students to collect and value ink cartridges and toners for the benefit of their school
- Promotional channels: Internet and activities in schools
- Campaign slogan: “Learn more about the environment and how to protect it”
- Funding: European Union funding

Educational programme “Ecovalor”

“Ecovalor” is a programme for environmental education and awareness, designed exclusively for the school community. Launched in 2002, it is currently having its eleventh edition. Supported activities focus on the competition between schools for separate disposal of plastic and metal waste from the educational establishments participating in the initiative. As part of this activity rewards are

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given to those schools which have accumulated the greatest amounts of waste that is disposed of separately, both in absolute numbers and per capita. By encouraging competition between schools, students have the opportunity to create more connections with each other and start making more efforts to achieve their goals. This leads to the expansion of the activities of separate waste collection and dissemination of the concept of utility of recycling among a significant number of schools in Portugal, as it covers even the youngest pupils.

National contest for youth environmental reports

The contest is aimed at promoting the interest in research on sustainable development and addressing environmental issues. It aims to encourage journalistic talent among pupils in Portugal and to support the creation of quality materials in various formats: paper, photos and video. The national contest encourages the creation of materials from young reporters. This is achieved by challenging secondary school students to explore environmental issues while developing their journalistic skills. This unique campaign has led to the formation of more stable relations between students involved in finding solutions to problems affecting the environment. The combination of different arts, such as journalism and photography has allowed students to discover their connection to nature and to get used to conducting studies to gain a deeper understanding of the subject, thereby increasing their awareness of the challenges and possible solutions. The contest has proven to be a well designed and successfully implemented extracurricular activity, allowing students to find a fresh perspective on some basic and well known problems.

“Biosphere” campaign to raise awareness

The aim of the programme is to raise the public awareness in Portugal on global environmental problems and to give advice and ideas on how to care for the Earth. It covers many topics of interest to the general audience related to water conservation, environmental approaches in the development of agriculture, renewable energy, recycling of wastes and biodiversity conservation. Also, reports are broadcasted on specific topics, such as ways to neutralise the sludge found in the soil as a result of illegal dumping of toxic substances, the use of eco-design for sustainable integration of buildings in the surrounding environment, ways to capture emissions of dust particles in urban areas by growing new plant varieties, etc. The success of this project is mainly based on the use of television as a channel for the promotion of ideas, and is a result of the creation of an online format for those who are more interested and want to learn more about what we can do for our nature.

Amigos do Ambiente (“Friends of Nature”)

This is an animation series for children, aiming to teach them how to be friends of the environment by giving them advices on how to take care of the surrounding nature in their daily lives. Emitting series of cartoons in one of the most watched TV programmes reaches the youngest part of the population. The mode of transmission of the message is carefully targeted and due to this the programme has great success. The episodes are distinguished by simplicity and intelligent approach, and therefore their content is viewed very easily. As a result, children are more friendly to the environment, because its protection is now a popular activity among them.

Desafio Verde (“Green Challenge”)

“Green Challenge” is an innovative educational programme that demonstrates how you can be environmentally friendly without being an extremist. As a weekly event, broadcasted on RTP2, it encourages real people to change their lives in order to reduce their environmental footprint. The contest has the format of a reality show. Throughout this process, the greatest challenge of all is to educate families and spectators and learn them what to change and how to stick to their new lifestyle. By analysing the daily habits of specific families, the programme shows how to save money, at the same time improving the living conditions in the respective regions, thus contributing to the sustainability of the planet.

Terra Alerta (“Earth Alert”)

The programme includes weekly reports on sustainable development and nature conservation, and presents profiles of inspiring people to describe their professional or volunteer work in protecting the

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environment and improving the quality of life. This project is very successful, mainly due to the use of television news, which attract all groups of people. Thus, the appeal of the programme is engaging the attention of the general public and is encouraging behaviour that contributes to the preservation of environment.

ESTONIA

3. Green practices in Estonia

Estonia is a member state of the European Union (EU) and OECD with a population of approximately 1,34 million inhabitants. Estonia continues to face significant transition challenges in the area of sustainable energy. The financing of start-up companies via venture capital funds also remains under-developed. Since regaining independence in 1991, the use of natural resources in Estonia has been taxed and the polluter pays principle applied in order to motivate companies to contribute to the development of environmentally sparing technologies and new equipment. The Estonian taxation system has been revised in order to apply the principles of green tax reform to conserve natural resources and the environment. General government spending on environmental protection rose from 0.7% to 0.9% of gross domestic product (GDP) between 2000 and 2012, just above the EU-28 average. Major public funds support upgrading the municipal water supply and wastewater treatment. Investments should be better monitored to ensure they support government priorities and reflect the principles of sound public finance. Production enterprises more than doubled spending on pollution abatement over 2010-13, although it focuses more on end-of-pipe than process-integrated technologies. Estonia is committed to the EU climate and energy package. One of the country’s official priorities is the reduction of negative environmental of energy use and the promotion of resource efficiency together with sustainable consumption and production patterns. Estonian economy is highly dependent on the supply of fossil fuels, approximately 90% of electricity is produced through the combustion of indigenous fossil fuels (oil shale) and the remaining 10% comes from renewable sources, primarily from combined heat and power production based on bio-fuels and wind power. The oil shale mining and processing sector still causes considerable damage to the air, soil and water. According to the Development Plan of the Estonian Electricity Sector until 2018 and the National Development Plan of the Energy Sector until 2020 the energy supply will be diversified and more different sources of energy will be used. Estonia is pursuing an ambitious green tax reform, and the environmental goods and services sector is developing fast. However, the country needs to accelerate the transition to a green, low-carbon economy. opportunities well-established environmental institutions an abundance of natural assets: plentiful water and forests covering half of the territory a developed system of spatial planning, modernised in 2015 vibrant environmental democracy and comprehensive environmental education ongoing green tax reform, aiming to shift part of the tax burden from income to resource consumption and pollution extensive protected areas, and a larger share of healthy species and habitats than in the rest of Europe.

3.1. Effective approaches and green measures for maintenance of sustainable ecosystems and improvement of the soil, air and water in Estonia

Estonia’s performance in terms of circular economy varies. The circular (secondary) use of material was 11.8 % in 2016 (EU-28 average 11.7 %), while the number of people employed in the circular economy in Estonia is above the EU-28 average (2.01 % of total employment in 2016, against an EU-28 average of 1.73 %). In the 2017 Special Eurobarometer 468 on attitudes of EU citizens towards the environment, 89 % of Estonian people said they were concerned about the effects of plastic products on the environment (EU-28 average 87 %). 85 % said they were worried about the

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impact of chemicals (EU-28 average 90 %)3. There appears to be general support for circular economy initiatives and environmental protection actions in Estonian society. The Ministry of Rural Affairs, the Ministry of the Environment, and the Ministry of Economic Affairs and Communication are all in principle responsible for setting and implementing circular economy policies. This fragmented responsibility makes it harder to implement comprehensive circular policies. During the second half of 2018, Estonia announced the preparation of a circular economy action plan and strategy. The action plan takes a long-term strategic approach, with different actions envisaged for the shortand medium term, including green public procurement, voluntary instruments and economic measures. The most recent waste-related policy initiative, Estonia's national waste management plan (NWMP) for 2014-2020, has already adopted the underlying principles of the circular economy. In the context of the multiannual financial framework for 2014-2020, Estonia has decided to invest EUR 111 million in more resource-efficient solutions, mainly in SMEs in the manufacturing industry. Funding went to raising awareness (events started in 2016), training resource specialists/auditors, supporting resource audits and investing in resource efficient solutions. The number of EU Ecolabel products and EMAS-licensed organisations in a country can give a rough measurement of the circular economy transition. These two indicators show to what extent this transition is engaging the private sector and other national stakeholders. These two indicators also show the commitment of public authorities to policies that support the circular economy. As of September 2018, Estonia had 311 products and 13 licences registered in the EU Ecolabel scheme, out of 71 707 products and 2 167 licences the EU. This shows significant take-up of these licences. Moreover, as of May 2018 5 organisations from Estonia were registered in EMAS.

Energy saving and management and renewable energy generation are the main contributors to a dynamic environmental goods and services sector. In 2013, 0.7% of total employment was related to renewable energy, above the EU average. Public procurement could boost these markets and improve business behaviour.

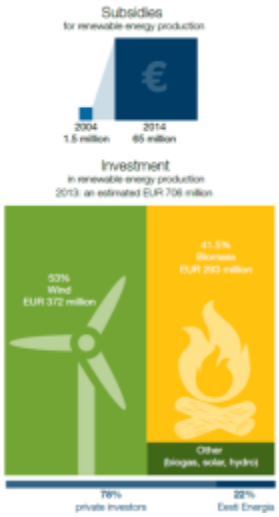

Figure 15. Estonia is promoting renewable energy; Source: Environmental Performance Reviews, 2017

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SMEs and resource efficiency

Estonian SMEs perform in line with the EU-28 average on environmental aspects. There is significant divergence among indicators, however. The percentage of SMEs that have taken up resource efficiency measures is the lowest in the EU, despite the fact that nearly 50 % of Estonia's SMEs benefited from public support measures for such actions. There has been considerable policy action in this area in recent years, for example Green Industry Innovation Estonia and support grants for agricultural, processing and non-farming rural businesses to use renewable energy, organic raw materials and eco-friendly processes. The Environmental Investment Centre (Keskkonnainvesteeringute Keskuse — KIK) also supports eco-friendly business.

Maintaining and restoring ecosystems and their services

The EU has provided guidance on the further deployment of green and blue infrastructure in Estonia and a country page on the Biodiversity Information System for Europe (BISE). This information will also contribute to the final evaluation of the EU Biodiversity Strategy to 2020. Estonia views spatial planning as the appropriate mechanism through which to create ecological networks. Green infrastructure is developed through the Estonian Green Network, based on a national spatial plan and county-level thematic spatial plans. The Green Network was set up in 2000 and covers about half of Estonia's territory. While the principle of the ecosystem approach has been introduced into all major national programmes, strategies and development plans, there is no methodology for how it should be implemented in practice. Furthermore, the implementation of county plans remains a challenge. In larger cities, especially Tallinn, the area, cohesion and biodiversity of the Green Network is decreasing and the pressure on protected areas is growing. There is therefore room to improve Tallin's Green Network. The Estonia 2030+ national spatial plan envisages national guidelines that would improve the quality of space while taking into account public interest. Several LIFE projects that include green infrastructure elements are ongoing. They relate to the conservation and restoration of Mire habitats, Estonian alvar grasslands, and petrifying spring habitats. EU funds are the main source of funding for green infrastructure in Estonia.

Making cities more sustainable

EU policy on the urban environment encourages cities to put policies in place for sustainable urban planning and design. These should include innovative approaches to urban public transport and mobility, sustainable buildings, energy efficiency and urban biodiversity conservation. The population living in urban areas in Europe is projected to rise to just over 80% by 2050. Urban areas pose particular challenges for the environment and human health, but they also provide opportunities for using resources more efficiently. The EU encourages municipalities to become greener through initiatives such as the Green Capital Award, the Green Leaf Award and the Green City Tool. Estonia has allocated EUR 101 million or 5.4 % of its allocation under the ERDF to sustainable urban development. The country participates in the European UDN, which includes more than 500 cities across the EU responsible for carrying out integrated measures based on sustainable urban development strategies financed by ERDF in 2014-2020.

Participation in EU urban initiatives and networks

Estonian municipalities are generally involved in EU initiatives on environmental protection and climate change. A number of initiatives are organised under the Union of the Baltic Cities Sustainable Cities Commission, a voluntary network of cities in the Baltic Sea region. This network addresses a number of issues, including environmentally sustainable development. It runs projects in areas such as integrated management systems and spatial management, urban water management, maritime activities and sustainable urban mobility. In addition, Tallinn's urban planning department is a partner in the Baltic Urban Lab project, which aims to identify and promote best practices in brown field regeneration. Estonian cities participate in initiatives such as Eurocities and the EU Covenant of Mayors. As of June 2018, five Estonian cities were signed up to the EU Convenant of Mayors. Tallinn and Tartu are involved in the URBACT initiative to support sustainable urban development, through different thematic networks. These welcome urban initiatives and networks contribute to a better

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urban environment. In 2017, 8.5 % of the Estonian population living in cities said that their neighbourhood was affected by pollution, grime or other environmental problems, down from 12.5 % in 2016 and 14 % in 2015. These figures are lower than the EU-28 average (20 % in 2017, 18.9 % in 2016 and 19.2 % in 2015).

Nature and cities

Around 16 % of Estonia's Natura 2000 network is in functional urban areas, just above the EU average of 15 %. Estonia has the biggest budget for Natura 2000 private forest land support among EU Member States: EUR 28 million for 2014. It is not considering other payments for ecosystem services. While the private nature tourism industry generates an annual turnover of EUR 10- 15 million, access to all protected areas, even on private property, is free in accordance with the Nordic principle of free access to nature. When it comes to biodiversity, Tallinn has a particularly strong planning process, starting with good mapping based on survey work for species and habitats and backed by bio-data inventories and research. Furthermore, the city has a good organisational structure, overseen by overall strategic plans (the Tallinn Environmental Strategy to 2030 and the Tallinn Environmental Protection Plan 2013-2018) and local action plans, with shared objectives throughout. Policies are linked through the different planning levels and involve a good variety of implementation measures and projects. A biodiversity action plan has been developed, as have the management plans for all of Estonia's protected areas, including the Pääsküla Bog Conservation Area.

Traffic congestion and urban mobility

The number of hours spent annually in road congestion fell from 20.32 in 2014 to 18.66 in 2016 and is now one of the lowest in the EU. Tallinn City Council decided to introduce free public transport in order to increase social inclusion, boost the local economy and contribute to protecting the environment. This increased the number of passengers by 6 % in 2013 compared with 2012. In October 2013, Tallinn made people's train fares for trips within city borders free. The number of train journeys within the city increased 2.3 times in 2014 compared with 2012. There has also been significant investment in the public 22 transport system in Tallinn's city centre: 28.6 km of former car lanes have been turned into public transport lanes. The urban area action plans for Tallinn, Tartu and Pärnu focus on increasing the proportion of people using sustainable means of mobility and providing residents with nursery school and childcare options near their homes. The urban area action plans for Narva and Kohtla-Järve/Jõhvi focus on increasing the proportion of people using sustainable means of mobility and reviving major underused districts. An environmental information screen has been set up in Tallinn's city centre to inform people about the status of ambient air, the most recent noise map and the changing PM10 levels.

Green public procurement

A National Action Plan (NAP) or a National Strategy on GPP is currently not in force in Estonia. However, the Ministry of the Environment has set the targets of having 15% GPP from all the procurements in public sector by 2018, developing an e-procurement platform in collaboration with the Ministry of Finance. Trainings are also organised for local government and state authorities' specialists, explaining the concept of an environmentally sound procurement, possibilities for conducting this, etc. Environmentally-friendly requirements are currently only mandatory for vehicles. Mandatory GPP criteria will also be introduced for the central government sector, furniture, cleaning products and services, copying and graphic paper and computers and monitors. GPP is periodically monitored through the official electronic public procurement website (EProcurement Estonia). In 2015, there were 10 850 public procurements in Estonia, of which 605 (5.6 %) included green criteria. In 2016, there were 10 343 public procurements in Estonia, of which 597 included green criteria (5.8 %). In October 2017, Estonia co-organised and hosted the 2nd Circular Procurement Congress in Tallinn.

Adaptability, reform dynamics and innovation (eGovernment)

When it comes to eGovernment, Estonia is among the EU's leading countries. It is among the five EU countries that are very close to having a fully developed digital channel for public services, with a

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score above 95 %. Estonia uses digital identification, digital signing, paperfree e-Government and more. In the DESI Report 2018, Estonia had a score of 77 out of 100 on digital public services, higher than the EU average of 58. Environmental authorities use electronic services that make it possible for the public to interact with them online. Since the introduction of digital signing and digital identification, digital means of communication are the public's preferred choice. Environmental authorities aim to provide all their services electronically. The Environmental Board has recently introduced a new portal for environmental decisions (Keskkonnalubade Infosüsteem KOTKAS). It replaces the older, more cumbersome e-service. Installations needing environmental permits submit all their data and applications electronically.As part of Estonia's continuous efforts to improve its egovernance, an environmental monitoring database that would improve access to monitoring data is being developed. For water quality data, a comprehensive modelling system with integration of relevant data is being developed. Water quality data is currently rather difficult to find and/or to understand without expert knowledge. The new modelling system could significantly improve the quality of environmental information and its accessibility.

Enabling financing and effective use of funds

Estonia created the Environmental Investment Centre to finance environmental activities and investment projects. The fund's website provides clear information about funding opportunities. Funding is available for the following areas: energy and reduction of air emissions; the circular economy; waste; fisheries; environmental education; environmental management systems; environmental monitoring and surveillance; nature conservation; mineral resources; marine environment; forestry; water. The Environmental Investment Centre is the implementing agency for funding financed by the state and funding available from the EU funds. Calls for applications are usually published in national newsletters and on the websites of the Ministry of Environment and the centre itself.

3.2. Green practices for maintenance of sustainable ecosystems in Estonia

Eco-innovations

Albeit the demand for eco-innovative products and services has increased at the business level in recent years in Estonia, most of the investments have been made in traditional environmental technologies, e.g., technologies that ensure the quality of water, air and waste management, or various energy related technologies. The biggest potential for eco-innovation initiatives within the smart specialisation framework arises in the areas of ICT, as an enabler of eco-innovative ICT solutions, and the use of smart technologies for more efficient resource management in the building and energy sectors. The field has seen numerous eco-innovation solutions in the past few years, largely due to initiatives that have raised awareness and the financial support available for companies. Furthermore, a more comprehensive support system for companies pursuing eco-innovation has emerged. An Energy and Environmental Technology Development Centre (RoheTAK) was established at the end of 2014, with an aim to support the growth of viable companies in the energy and environmental technology areas. The companies participating have launched an initiative to become a cleantech cluster. The Green Industry Innovation support programme, started in 2013 in cooperation with donor partner Innovation Norway, has successfully supported its first 15 companies and is expected to continue in the future. Moreover, the strong start-up culture in the country has contributed to the fast development of the eco-innovation activities in Estonia, with support structures – such as the Tehnopol business incubator, Mektory (Innovation and Business Centre of Tallinn University of Technology, founded in 2013) and other business incubators and university-business cooperation centres, such as Tartu Science Park having led the way in providing initial support for start-ups. In 2016, the Estonian government put in place several measures that support Research and Development (R&D). The most important of these are: a specific development programme for companies with distinctively high growth potential; more tailored and effective support for public procurement of innovation; a more active engagement of financial instruments; and an industrial policy green book'.

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The strengthening cooperation between universities, public sector and businesses in the area of eco-innovation initiatives has led to examples emerging in the areas of smart cities and e-service, such as the bike parking system BIKEEP, an e-planner for public transport and other e-government initiatives, and further growth of Ülemiste Smart City. Eco-innovation was also one of the priorities for the Estonian EU presidency in 2017. Estonia is looking for ways to engage young software programmers across the EU in a coding competition (hackathon) specifically addressing eco-efficiency/circular economy challenges. As regards good practices in Estonia, Ocean Visuals developed complementary solutions for the oil-spill detection system Ocean Visuals, based on information and laser remote-sensing technology, as part of the Green Industry Innovation support scheme supported by European Economic Area (EEA) Grants.

3.3. Applicable models in waste management field

Advanced Sports Installations Europe AS (ASIE): The concerned company has developed a new technology to reuse and recycle all materials of artificial grass pitches on site. A boom of such pitches has come along with increased environmental problems, as recycling methods for these pitches continue to be sparse and limited as regards their resource efficiency. ASIE has developed a method to considerably expand the life-cycle of artificial grass pitches by transplanting them from professional sports facilities to public, training or school sports fields after the turf has become unsuitable for professional purposes (e.g. FIFA requires a maximum life span of 6 years for artificial grass pitches). ASIE promises to enable a 50% cost reduction of the formerly used field utilisation and 50% savings from new installations. Furthermore, the Estonian company claims to prevent 1 million tonnes of mixed waste to go into landfills p.a., and significantly reduce the need for field renewal transportation, thereby emitting 95% less CO_2 in the process as usual. The company has received a grant from the European Commission under the 2020 SME programme as well as Enterprise Europe.

Aus Disain OÜ: Aus Disain OÜ has made considerable steps towards eco-innovation in the fashion industry, which is one of the most wasteful fields of business after energy sector (Aus, 2011). They make rigorous use of the concept of ‘upcycling’, which stands for the conversion of waste materials or useless products into new materials or products of better quality or for better environmental value. In 2013 the team announced a new fashion collection that was upcycled from a large amount of waste materials of one of the biggest textile manufacturers in Bangladesh, Bexmico. All products are available to buy online. Their products were chosen to dress the participants of Estonian Song and Dance Festival in 2014.

GPS-based map helps 50.000 volunteers in cleaning illegal garbage dumps. About 10.000 tons of illegal waste was lying around all over Estonia, but on the 3rd of May 2008 more than 50.000 volunteers – about 3% of Estonian population – came out to clean up forests, roadsides and other public areas in a nationwide cleanup campaign (Let’s Do It! 2008). More than 40 waste management companies supported the initiative with necessary containers and garbage transportation vehicles. Before the actual cleanup work started, the campaigners used special software based on Google Earth, positioning software for mobile phones and mobile phones with GPS to map and photograph 11.000 illegal garbage dumps across all 45.227 square kilometres of Estonia. The software can be used both in similar future campaigns in Estonia and in much larger and garbage-richer countries, such as India.

Waste incineration plants to produce electricity and heat: Although common household waste has a similar calorific value to oil shale, over 300,000 tonnes of waste that would be suitable for energy production is taken to landfills in Estonia every year. To make better use of this local resource, Eesti Energia started preparations in 2006 to build a waste incineration unit in Iru. For municipal waste to be reused even more efficiently, mechanical and biological processing plants are needed all over Estonia. The Iru waste incineration unit incinerate up to 220,000 tonnes a year of mixed municipal waste from around Estonia. This allows to save nearly 70 million cubic metres of natural gas per year and improve Estonia's energy security and foreign trade balance. The new CHP plant produces electricity and heat from waste all year round from 2012. The plant is able to produce 50

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MW of heat and 17 MW of electricity. The waste incineration supplements the existing power plant in Iru (Eesti Energia 2010).

Tallinn knows how to recycle. Since 2008, municipalities have used EU and domestic funds to build about 100 collection points across the country for recyclables, garden and park waste, household hazardous waste and electrical and electronic equipment. Tallinn's scheme for recyclable waste has gone further, providing containers for recyclable waste near residential buildings. As a result, Tallinn reached a separate collection rate of 53% of all MSW in 2012, the third highest among EU capital cities: 85% of glass and 74% of paper waste were collected. In Tallinn, biodegradable waste is also collected from apartment buildings, restaurants and food shops.

Changing behaviours, one car repair shop at a time. In 2013, a trade association noticed that a significant number of repair shops were not turning over all their waste oil to waste management companies. The Environmental Research Centre confirmed that up to half of repair shops' waste oil was not reaching the legal waste management system. After verifying this information, the Environmental Inspectorate (EI) reminded an initial group of potentially problematic repair shops of their waste management obligations. In addition, the Environmental Board, Estonian Waste Management Association and AMTEL jointly organised an "Information Day", accompanied by a press release. More than half of the 100 operators invited took part in the event. Over the next several months, the EI monitored behavioural changes in the repair shops based on data from waste management companies. At the end of this "grace period", the EI and the police inspected 105 repair shops. Followup inspections were carried out in non-compliant establishments.

3.4. Applicable models for maintenance of sustainable ecosystems and improvement of the soil, air and water in Estonia

Institute of Circular Economy and Technology: The Institute of Circular Economy and Technology is part of the Tallinna Tehnikakxrgkool (University of Applied Sciences Tallinn) and was established in 2017. The institute offers studies in Environmental Technology and Management, Industrial Technology and Marketing, as well as Production and Production Management. Specifically the latter focus is crucial for the institute's aspirations with respect to the circular economy, as the production process is considered to be an essential period during which a multitude of environmental factors (especially resource efficiency) can be addressed. Managerial and administrative processes as well as technical distribution and maintenance are further elements targeted. The Institute of Circular Economy and technology furthermore engages in international projects coordinated by Nordplus, with the aim of developing and communicating a practical approach for teaching principles and mechanisms of the circular economy.

Estonian Cell which started its operations in 2006 in Kunda, produces high-quality Bleached Chemi-Thermo-Mechanical aspen pulp. Between 2012-2014 the owner company of the manufacturing company Heinzel invested EUR 17 million in improving efficiency and securing the sustainability of the site. As a result, a reactor was developed which uses the site's wastewater and turns it into biogas. This allows the company gradually to replace natural gas with biogas in their production. In 2015, the company produced more than 5 million cubic meters of biogas, becoming the largest biogas producer in Estonia. In 2014, Estonian Cell was named Environmentally Friendly Enterprise of the Year by the Estonian Ministry of Environment.

Skeleton Technologies: The company manufactures ultracapacitors and delivers high-power and high-energy storage solutions, primarily for the automotive, aerospace, industrial and renewables sectors. The first series of ultracapacitors were launched in 2012 and have been welcomed by the market due to doubled energy density and five times the power density of previous technological solutions. The company is included in the 2015 Global Cleantech 100 list.

Ocean Visuals (ICD Industries Estonia OÜ): The company developed complementary solutions for the oil-spill detection system Ocean Visuals, based on information and laser remote-sensing technology, as part of the Green Industry Innovation support scheme supported by EEA Grants. The

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technology is based on Hyperspectral Lidar technology and can classify the type of oil in the water, measure the thickness of the oil in the water, provide real-time data feed for early warning of oil spills, etc. The resulting data is shown on a map-based graphic user interface available on web and IOS platforms as well as desktop applications. The complementary solutions financed by the project included the development of a monitoring system that provides continuous detection of oil pollution in difficult conditions, such as icy waters and submerged oil.

Pakri Science and Industrial Park: PAKRI is a privately owned science park that works in close partnership with public and governmental organisations. It combines competence, R&D, manufacturing and a testing centre, which focuses on renewable energy, energy in housing, smart grid, smart-city, energy storing, electrical vehicles and green fuel. Among other aspects, PAKRI Smart-City features an autonomous smart grid, which is one of the largest autonomous renewable energy smart grids in the region. The science park has close cooperation ties with Science Park Tehnopol.

The creation of the centre is one of the first initiatives in Estonia clearly targeted at improvements in circular economy. The centre received its operating permit in spring 2016, starting its activities soon after. The centre will be providing certification for goods that have been made using recycled materials, for example, compost produced from production waste. The initiative aims to reassure consumers that the goods bought are of good quality and meet specific standards. The long-term perspective of the centre is to become an autonomous conformity assessment unit for different types of products made of recycled waste, including fermentation waste from biogas production, sewage sludge compost and goods produced from construction and demolition waste

Werrowool OÜ: Werrowool has developed an excellent cellulose fiber based insulation material. The builders of passive and energy efficient buildings all over the world prefer cellulose fiber wool in order to ensure good heat resistance and low heating costs. The company was also recognised as the most environmentally friendly company of Estonia in 2013 not only because its output product complies with all the relevant standards, but also the whole underlying idea for the enterprise has been to ensure eco-sustainable product lifecycle.

Ääsmäe community-village (with a population of 822 inhabitants) has developed a plan to establish an energetically self-sustaining village including transferring all local businesses/factories to renewable power sources. The initiative shows its eco-innovative character through the planning process of the whole system. The new village community centre building is planned to meet the criteria of Passive House Standard and will be used later in ecological building training courses as a living example of a low or zero-energy consumption building. Also, all construction materials used in Passive-House-Community-Centre-Building should be natural (not industrial), such as wood, clay or cellulose fiber. The aim is to use the best possible technologies to build passive and hybrid houses in all other new buildings later on. The vision for the future is that all electricity, heat energy and transport fuels will be produced from local sources such as biofuels (bio methane), geothermal pumps and solar panels, renewable bio-ethanol is already produced in Kadarbiku Köögivili OÜ in Ääsmäe. As the community’s plans involve creating an ecological educational and renewable energy theme park, the initiative is not only about establishing existing solutions, but to promote a general mind-set of ecological thinking and eco-innovation.

Elumaja zero-energy houses: Elumaja is the first innovative integrated solution on the Estonian construction market for manufacturing a highly efficient module house. The concept of the module house enables to use autonomous renewable energy solutions and, if necessary, live independently from a central infrastructure, i.e. without any CO_2 emissions. A zero-energy house means that its use does not require more energy than the building itself can generate. Elumaja can be used both as a home or an office, or even a home office. The process starts by identifying the customer’s needs and is tailor-made. The module house is manufactured in the course of a standard construction process that ensures high quality, short delivery times and a fixed price. Elumaja is made up of a 45 m² base module that ensures energy efficiency, a healthy interior climate and add-on modules that allow

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extending the housing space flexibly to 90 or 135 m², as necessary. Also, larger houses can be ordered with the same three characteristics: mobility, flexibility and independence. The zero-energy house is equipped with zero-energy solutions, including a solar heating system, energy-producing solar panels, a windmill and batteries. The most important element in choosing materials for the zero-energy house is the amount of primary energy, i.e. the amount of energy and emissions used for producing and transporting the materials, the given amount of greenhouse gases and the resource cost during the whole use of the building. The company prefers to use little-processed local materials with verified composition and that do not contain components that may be hazardous. Materials of non-local origin (such as air traps and steam traps) are certified by competent European Union bodies to ensure protection of human health and the environment. All materials used in the zero-energy house are renewable or can be disposed of safely. The use of such environmentally friendly materials in construction of the whole building is new in Estonia. The ecological footprint of the zero-energy house is the smallest possible, without compromising anything on convenience or durability. In zero-energy buildings there are no materials that are based on oil products or whose production process is energy-intensive. The materials used in construction of the zero-energy house can be recycled or safely disposed of.

The Narva power plants have started using biofuel Between autumn 2009 and summer 2010 the power plants in Narva used biomass for about 10% of their fuel, which is burned together with oil shale in the two circulating fluidised bed energy blocks. This significantly increased the proportion of renewable energy both in the portfolio of state-owned energy company (Eesti Energia 2010) and in the overall electricity production in Estonia. Changes introduced in summer 2010 to the system of subsidies for renewable energy production meant that continuing to use biomass is economically feasible only in the combined heat and power block of the energy company`s Balti plant in Narva. The new energy block produces an average of 130-140 GWh of renewable energy each year, which is enough to cover 2% of yearly electricity consumption in Estonia. It should be noted that after the power plant started to use biofuel the prices of wood increased significantly as a significant amount of raw material was taken away from the market. Indirectly, this price increase in the wood market also contributed to a price increase in the heating costs of households and smaller power plants.

Ecowall: Many family homes are built with bricks and concrete block walls – a process which needs a lot of energy and raw materials. EcoWall aims to reduce those requirements and associated environmental impacts by producing modular composite concrete panels that offer savings in construction costs and improved thermal insulation. EcoWall will use industrial waste materials and recycled concrete aggregates to make the panels. Foamed concrete will provide insulation, which in turn will save energy. The objective is to produce a long-lasting and durable product which retains the attractive appearance of traditional materials.

JAPAN

4. Green practices in Japan

Despite major problems such as a rapidly aging population and an alarmingly high level of public debt, Japan remains one of the world’s leading economies. Its rate of per capita economic growth is in line with that in the United States or the European Union. Japan provides a high standard of living and safe living conditions for more than 125 million people. Over the last half century, the country has been a symbol of environmental change. Evidence now points to a coordinated attempt on the part of Japan to become a global leader in the development of scientific, technological, and public policy solutions to the worldwide environmental crisis. Between 2001 and 2011, Japan had the most patents

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in the world in energy-efficient buildings and lighting and in electric and hybrid vehicles and the second-most (behind the U.S.) in renewable energy and waste management.

Japan

Region	Asia-Pacific
GDP	4971.80 [PPP 2011$ billions]
GDP per capita	39293.69 [$]
Population	126.53 [millions]
Urbanization	91.78 [%]
Land Area	373128.87 [sq. km]

Japan has made steady progress in addressing a range of traditional environmental problems, notably air emissions, water pollution, and waste management. However, several more complex, long-term challenges have come to the fore requiring new and improved policies; in particular, climate change, sound materials management, and biodiversity conservation. Relatively poor in natural resources and very densely populated, Japan has strong incentives to manage its land, energy and natural resources efficiently, particularly through innovative technologies and systems. More than two-thirds of the country is covered by forests, and the vast majority of the population, infrastructure and economic activities are concentrated in coastal plains and basins, resulting in considerable environmental pressures in these areas. Japan has ambitions to become a Leading Environmental Nation as declared in its “Strategy in the 21st Century: Japan's Strategy for a Sustainable Society". Eco-innovation is at the heart of the strategy. A number of key strategic policy documents explicitly refer to that concept: eco-innovation has been referenced in the Innovation 25 (a Cabinet Decision of June 2007), in the 21 Century Environment Nation Strategy (a Cabinet Decision of June 2007), in the Economic Growth Initiative (as revised in June 2007) and in the Economic and Fiscal Reform 2007 (Basic Policies) (a Cabinet Decision of June 2007). In 2009, Japan had pledged to reduce its GHG emissions by 25% from 1990 to 2020. This ambitious pledge largely relied on plans to increase nuclear power’s share in electricity supply from 30% to 50%. After March 2011, however, the country’s entire nuclear power capacity was gradually shut down in the aftermath of the Fukushima Daiichi nuclear accident and came to a complete halt in 2013. As of 2015, more than 40 coal-fired power plants are planned or under construction in Japan, following the switching-off of Japan's nuclear fleet following the 2011 Fukushima nuclear disaster. Prior to this incident, Japan's emissions had been on the decline, largely because their nuclear power plants created no emissions. Japan ranks 20th in the 2018 Environmental Performance Index, which measures a nation's commitment to environmental sustainability. As the host and signatory of the 1997 Kyoto Protocol, Japan is under treaty obligation to reduce its carbon dioxide emissions and to take other steps to curb climate change.

Greening the tax system

Japan’s tax system differs from that of many other countries in several respects. In particular, the tax revenue to GDP ratio is one of the lowest in the OECD area (28.1% in 2008, compared to the OECD average of 34.8%). Revenues from indirect taxes on goods and services, including those on energy and transport, account for a much lower share of tax receipts than the average for the other OECD countries (18% of tax receipts in 2008, compared to 31.7%). Environmentally related tax revenues largely consist of revenues from taxes on energy use and vehicles. Japan imposes a multiplicity of such taxes, some of which are collected at local level. Revenues from environmentally related taxes (in real terms) increased by about 6% between 2000 and 2007, before sharply decreasing as a consequence of the economic crisis. They accounted for 1.7% of GDP in 2009. This share is in line with the OECD weighted average, although well below the OECD Europe average, and it has slightly decreased since the late 1990s. Revenues from environmentally related taxes fluctuated around 6% of total tax receipts for most of the 2000s, a share above the OECD weighted average, though in the lower half of OECD countries. However, this share soared to over 10% in 2009, the

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second highest in OECD, as a result of the negative impact of the economic recession on overall tax receipts. Energy taxes play a relatively minor role in Japan compared with other major economies, accounting for about 60% of environmentally related tax revenues. Taxes on fuels for transport purposes account for some 83% of the revenue from energy-related taxes. Japan's taxation of transport fuels stands out among OECD countries in a number of ways. Japan is one of the few OECD countries taxing aviation fuel used on domestic flights. Gasoline and diesel taxes – and prices – are well below those of most OECD countries. In 2009, taxes accounted for 45% of the diesel price and 51% of the gasoline price, compared to a range of 50-60% of the diesel price and 62-68% of the gasoline price in the G7 European countries. This gives drivers a relatively weak incentive to drive energy efficiently even if they choose low-emission cars. The government has been discussing the introduction of a carbon tax for several years. In 2009, the Ministry of the Environment (MOE) proposed a tax of JPY 1 064 (USD 10) per tonne of CO_2 on fossil fuels, including transport fuels. This is a relatively low level compared to similar taxes applied in other countries (e.g. Finland and Sweden) and to the average price of a CO_2 allowance in the EU emissions trading system. Under the proposed carbon tax scheme, the gasoline tax would be simultaneously reduced, so that the final tax rate, including the carbon tax, would be comparable to the minimum rate applied in the EU. Japan provides fiscal support to both households and businesses. Households can claim tax credits for the purchase of new houses meeting energy efficiency standards and for the installation of energy efficient equipment, such as heat insulation materials and solar panels. Similarly, businesses can benefit from tax credits or special depreciation rates on investment costs for improving energy performance and controlling pollution. Owners of highly efficient buildings have access to low-interest loans. Preferential tax treatment or low interest rates are provided by governmental financial institutions to promote the use of equipment for high-temperature incineration, or for treating smoke and soot, PCBs or other types of waste. Tax credits are also given for investment in R&D.

Industrial emissions in cities

Japan's capital Tokyo is preparing to force industry to make big cuts in greenhouse gases, taking the lead in a country struggling to meet its Kyoto Protocol obligations. Tokyo's outspoken governor, Shintaro Ishihara, decided to go it alone and create Japan's first emissions cap system, reducing GHG emission by a total of 25% by 2020 from the 2000 level. On June 25, 2008, the Tokyo Metropolitan Assembly approved a program for the reduction of CO_2 emissions starting in 2010. About 1,300 large offices and factories in Tokyo that consume electric power equivalent to 1,500 kilolitres of crude oil annually must reduce CO_2 emissions by 15–20% of the average volume from the three years before this by law. Even with emissions trading or cap-and-trade, if the targeted reduction is not achieved by 2020, a penalty of up to JPY 500,000 will be charged. This penalty chargeable regulation is the first in Japan.

Industrial emissions

GHG emissions further increased; in 2007, they were 9% above the 1990 level, far exceeding the Kyoto Protocol target of reducing emissions by 6% on average over the 2008-12 period compared with the 1990 level. While the economic recession brought emissions of GHGs and of carbon dioxide (CO_2) from energy use down in 2008, this effect was temporary. CO_2 emissions from energy use had increased by nearly 5% between 2000 and 2007, a rate lower than GDP. As a result, the carbon intensity of the Japanese economy has decreased and is now below the OECD average. However, progress has been slower than in other major economies, mainly due to an increasingly high share of fossil fuels in the energy and electricity mix. Efficiency improvements have helped to moderate the increase of industrial emissions, and higher fuel efficiency of vehicles has largely contributed to the decline in CO_2 emissions from transport.

The Green Purchasing Network and Green public procurement

Practices of green purchasing in Japan go back to the late 1980s with the launch of the Eco Mark Program, which is a Type I environmental labelling scheme. The Green Purchasing Network (GPN) is a non-profit organisation (NPO) whose mission is to promote the ideas and practices of green

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purchasing in Japan. The GPN is unique because private sector, local governments, and other NPOs/NGOs have been engaged in its establishment and activities. Since its establishment in 1996, the GPN has taken a leading role through its activities. The Network's objectives are: - To disseminate the concept of, and promote the practice of green purchasing among the central and local governments, businesses, and consumers. To provide guidelines and information necessary for practicing green purchasing.

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- To disseminate the concept of, and promote the practice of green purchasing among the central and local governments, businesses, and consumers.
- To provide guidelines and information necessary for practicing green purchasing.

The GPN established the Principles of Green Purchasing.

- Consider Necessity - Consider whether a product is needed before purchasing it.
- Consider the Life-Cycle of Products and Services - Consider environmental impacts from the overall life cycle of a product, including those incurred through a service provided – from extraction of raw materials to disposal.
- Consider Supplier Efforts - Select products and services offered by suppliers who make a conscious effort to care for the environment.
- Collect and Use Environmental Information - Gather information on products, services, and their respective suppliers, and employ that information when purchasing them.

Along with an increase in adoption of environmental management, green purchases of companies have been strengthened. This trend is more obvious for large companies than SMEs: a survey conducted by GPN in 2003 shows that 96% of companies with more than 1,001 employees carry out green purchases, while companies with less than 300 employees stayed at 80%.

4.1. Effective approaches and green measures for maintenance of sustainable ecosystems and improvements of the soil, air and water in Japan

Measures towards circular economy (Figure 16)

Japan, an island with a high population and large mountainous terrain, explored the concept of Circular Economy (EC) after the global financial crisis some decades ago. The path to circularity in Japan was driven by a lack of landfill space due to rocky topography, limited domestic metal and mineral resources despite being a major industrial producer, and stagnating industries. The move to circularity started far back as 1870 but only yielded results when the law for effective utilisation of recyclables was implemented in 1991. Japan became the first country to enact CE legislation. The strategies employed were to reduce oil dependence and high-energy consumption industries, adjust energy structure, improve efficiency of energy utilisation, and develop knowledge-intensive industries. In 2007, 98% of Japan's metals were recycled and just 5% of its waste were landfilled. An enforced consumer's responsibility for returning electrical equipment resulted in the recovery of about 74%–89% of the materials. Transition to the CE in Japan has been characterised by effective collaboration between consumers and manufacturers. This started with the development of high technology and the advancement of technological knowledge, which decoupled use of non-renewable resources from production and created avenues to explore alternative energy and use of renewable resources. This has provided a firm foundation for Japan's CE system and built a CE society by integrating its people, economy, and social system through optimum utilisation of non-renewable resources and strategic changes for renewable resources.

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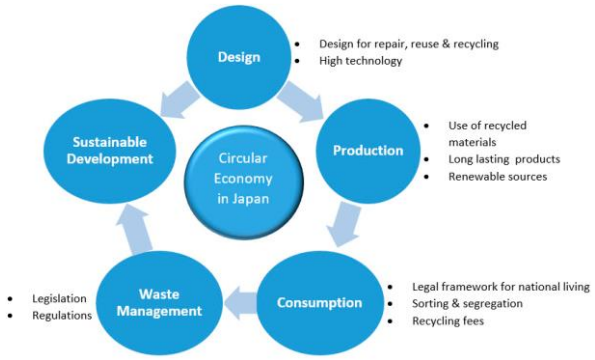

Figure 16. Circular economy development in Japan, Source: A Review of Circular Economy Development Models in China, Germany and Japan

As stated earlier, CE development in Japan is characterised by effective collaboration that requires the public or consumers and manufacturers to play their part. The role of the public is to include source separation of recyclables, prompt payment of recycling fees, and protecting their right as consumers. Manufacturers' roles are use of more recycled materials, production of long-lasting products, and design for repair, reuse, and recycling. Three levels of implementation including enterprises (the main implementing body), industrial parks (waste from one enterprise are transformed into raw material for another), and society (recycling society) were developed. The CE in Japan was developed in such a way that old materials or products are easily collected; the cost of return and recovery have been added to a product's cost when new and all companies are compelled to recycle their products. The CE practically became a lifestyle, making it not only an economic behaviour, but a social one. Recycling systems aimed at zero emission were developed, which consist of life cycle assessment system, waste minimisation system, resource recycling system, the industry chain of waste recycling and the recycling, transport and trading system of waste. These systems were supported by legislation and regulations. The implementation of the CE concept in Japan followed a top-down approach, using legislation and regulations. The government developed an all-inclusive legal framework for transition to a CE society, which later became a national living pattern. Important steps taken by the Japanese government to ensure circularity in all sectors include creation of educational courses on awareness of environmental issues in schools, companies, and communities, which is the foundation for CE development; provision of recycling laboratories in schools; provision of enterprises' circular trading markets; provision of incentives, enhancing public collaboration, and creating customer-friendly collection of old appliances; provision of waste recycling station.

Eco Mark Program

The Eco Mark Program implemented by the Japan Environment Association (JEA) is managed according to the ISO 14020 standard of the International Organisation for Standardisation (Environmental labels and declarations - General principles) and ISO 14024 (Environmental labels and declarations - Type I environmental labelling - Principles and procedures). This system is specified as a "system in which the use of labels is approved by a third-party organisation based on independent and varied criteria." Eco Mark criteria are taken into account regarding environment load in all the life stages of products (collection of resources, manufacturer, distribution, use and consumption, recycling and disposal) from environmental viewpoints, and are also considered in an additional 4 areas (resource saving and recycling, prevention of global warming, control of hazardous substances and conservation of diversity) to enhance credibility. The Eco Mark is designed to represent the wish "to protect the Earth and the environment by ourselves," presenting an image of the hands of a human that stand for "e" the first letter of the "Earth" and also of the "environment," embracing the Earth gently.

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The Eco Mark Program is a program implemented by the Japan Environment Association, which was started in 1989. It is intended to facilitate the selection of commodities by consumers who wish to lead environmentally friendly lives by providing information on products from the viewpoints of the environment through attaching the “Eco Mark” to products (goods or services) that are judged to be of help to environmental conservation. Commodities that are eligible to bear the Eco Mark must satisfy either of the following requirements. The commodities shall impose less environmental load than similar commodities throughout the life cycle of such commodities from “production” to “disposal”. The use of such commodities shall produce a great effect that contributes to environmental conservation such as enabling reduction of environmental load arising from any other causes.

University of Tsukuba

The University of Tsukuba is taking a lead to connect private sector, academic institutes, governments and local community, to bring the seed of innovative technology in practice. The initiative is called “Tsukuba Innovation Eco-system,” which provides fora for researchers to share their research outputs with companies and investors. In May 2015, University of Tsukuba set up a section, which coordinates information sharing or even sales the seed of technologies among researchers and companies for commercialisation. Tsukuba Global Innovation Promotion Agency (TGI), located at University of Tsukuba, assists cooperation of research institutes and strengthening of the relationships between research institutes and companies.

SMEs and resource efficiency

Because their financial and human resource foundations are relatively weak, SMEs require supports from the government such as subsidies and information sharing. There is strong support by the government through national strategies, and a number of measures to help companies, especially SMEs: financial assistance for R&D, information sharing for new business opportunities, technical supports. In a sense, they take part in national policy implementation through those supports. Government of Japan determined, in its National Growth strategies to support SMEs in their expansion of business into the growing business market, including the areas of environment and energy. Small Business Innovation Research (SBIR), started in 1999, is a collective mechanism used by a several ministries that assist R&D and commercialisation of technological development undertaken by SMEs through subsidies and other means, such as loans with low interest rate and patent fee exemption. SMEs literally contribute to national innovation strategies by advancing their own technologies. In 2015, the government aimed to subsidise JPY 45.5billion for the SBIR in total. J-Good Tech (started in April, 2014) assists SMEs to bring innovative seeds into commercialisation by match makings with large companies. More than 2,100 SMEs have put up their profile on the JGood Tech website, and sectors include energy, waste management, and water purification.

Sustainable and greener cities: Development of Eco-towns

The Japanese government certifies advanced environmentally harmonious areas as “Eco-Towns”. The Eco-Town Programme is a national initiative, launched in 1997, to reduce resourse use, extended the life of landfills and revitalise the local economy by optimising waste management and developing

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innovative recycling industries. Under this programme, the Ministry of the Environment provides grants to local authorities for town planning, community recycling and promotion and outreach activities in collaboration with citizens and NPOs; the Ministry of Economy, Trade and Industry (METI) provides investment subsidies to private enterprises willing to invest in innovative recycling projects. Between 1996 and 2006, 26 Eco-Town plans were implemented in Japan with various geographical targets: six metropolitan areas, six regions including several towns and/or villages, two islands, ten cities and two industrial or port areas. Approximately USD 1,65 billion were invested in 61 innovative recycling projects, with an average government subsidy of 36%. In addition, at least 107 other recycling facilities were constructed without government subsidy. Recycling projects concern mainly plastic, organic and MSW, waste electrical and electronic equipment and industrial waste. The Eco-Town Programme has provided a platform for the private sector to innovate and has contributed to improving the sector's productivity. In Eco-Towns, employment in the recycling sector has grown as a share of total employment.

Air quality monitoring

A continuous monitoring system for 11 air pollutants, the atmospheric Environmental Regional Observation System or "Soramame-kun", has been established **(Figure 17)**. There are two types of monitoring stations: those for the general atmospheric environment (1,581 stations in 2016), and those for roadside air monitoring (451 stations in 2016). The Soramame-kun website discloses the observed information almost in real time on a distribution map, where concentration values are reported using a colour coding system. Moreover, it discloses the status of photochemical oxidants advisory and warning alerts during the past seven days.

Figure 17. Soramame-kun distribution map, Source: Policies, regulatory framework and enforcement for air quality management: The case of Japan

When observed concentration values exceed predetermined thresholds, an advisory (注意報) or warning (警) alert is issued. In the former case, the prefectural governor informs the population about the worsening air quality and asks for the cooperation of firms to reduce the emissions of soot smoke and VOC as well as for the voluntary restraint of citizens in the use of automobiles. In case of "warning alerts", which are issued for heavier pollution levels, the prefectural governor can request necessary measures to reduce the soot and smoke concentration as well as prohibiting the circulation of vehicles if these are judged to be contributing to the peak in emissions. Warnings are announced to local citizens through a number of media, pre-registered emailing service, and smartphone application. Local governments usually have contact points where citizens can report critical air quality events.

Vehicle Taxes and Road Prices

Japan imposes taxes on the purchase and ownership of motor vehicles at prefectural and national levels. None of these taxes is directly based on the environmental performance or fuel efficiency of vehicles. Nonetheless, tax breaks were introduced to favour the purchase of more environment-

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friendly vehicles). As from 2001, the automobile tax was reduced by 25-50% depending on a vehicle's fuel efficiency and exhaust emission levels, and it was increased by 10% for old vehicles. The tax break was extended in 2009 to the acquisition tax and the motor vehicle tonnage tax. The so-called "next generation vehicles", including hybrid and plug-in hybrid, electric, clean diesel and compressed natural gas cars, are fully exempted. These tax breaks are set to be phased out in 2012. Technological advancement and tax incentives have helped to considerably improve average fuel efficiency of the road vehicle fleet, with a shift to smaller and more fuel-efficient cars. In addition to fuel and vehicle taxes, Japan applies a flexible and rather complex system of road pricing for it's nearly 9 000 kilometres of motorways. Lower rates apply to light vehicles and motorcycles. Discounts of 30 to 50% apply to motorway tolls at off-peak times, for long-distance use and on weekends. To divert traffic from congested roads running through residential areas, a discounted toll applies on some urban stretches of motorways (so-called "environmental road pricing"). Overall, despite high prices, the toll system encourages long-distance driving, including over routes that are very well served by fast trains. The measures recently approved would strengthen this incentive, whereas an appropriate implementation of the polluter-pays-principle would require road pricing to reflect both the distance travelled and the environmental performance of vehicles.

Other tax incentives

Japan provides fiscal support to both households and businesses. Households can claim tax credits for the purchase of new houses meeting energy efficiency standards and for the installation of energy efficient equipment, such as heat insulation materials and solar panels. Similarly, businesses can benefit from tax credits or special depreciation rates on investment costs for improving energy performance and controlling pollution. Owners of highly efficient buildings have access to low-interest loans. Preferential tax treatment or low interest rates are provided by governmental financial institutions to promote the use of equipment for high-temperature incineration, or for treating smoke and soot, PCBs or other types of waste.

4.2. Green practices for maintenance of sustainable ecosystems in Japan

Between 2007 and 2012, the number of threatened species identified in the Japanese Red List increased from 3,155 to 3,597. Indeed, the Red List identifies, as endangered species, over 20% of mammals and vascular plants, over 10% of birds and about 30% of the reptiles, amphibians and freshwater fishes. About one-third of the waterweed species in Japan are designated as threatened, and many other threatened species live in the waterside environment. According to a recently developed vegetation map, forests account for 67% of the total land area, including 17.9% of natural forests. Much of the natural vegetation (consisting of natural forests and natural grassland), which currently accounts for nearly 20% of Japan's total land area, is distributed in the natural mountain area. Japan's biodiversity is not particularly rich compared with other Asian countries. In 2008, Japan approved the Basic Act on Biodiversity, which is intended to guide the review of all nature-related legislation. As recommended in OECD Environmental Performance Review from 2002, Japan has revised its National Biodiversity Strategy. The most recent version provides a set of measures to halt biodiversity loss in Japan in short-term, and sets the target to improve the state of biodiversity by 2050. Over the last decade, pressures on biodiversity are rising and biodiversity sites have continued to deteriorate and fragment, reflecting insufficient attention given to nature protection within and outside protected areas. A relatively high portion of species faces a significant threat of extinction. Little progress has been made in expanding protected areas. Despite decreased fish production, Japan accounts for the second highest share of the world's fish catches. Agriculture is also a major source of pressure on biodiversity. While Japan has designated some 24% of its land area for protection, only 3% of the territory conforms with the more restrictive categories of protected areas used by the International Union for Conservation of Nature. There is significant scope to increase the portion of forests and marine areas dedicated to nature conservation. The variety of protection regimes has resulted in heterogeneous management practices. A further streamlining of nature conservation laws, and closer

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inter-ministerial co-operation, are needed to promote a more coherent approach to biodiversity conservation. In addition to its four main islands – Hokkaido, Honshu, Shikoku and Kyushu – Japan has over 6,800 large and small islands. These unique ecosystems possess distinctive biota and are highly vulnerable, being affected by the destruction of habitats and introduction of invasive species. For instance, in the Ryukyu Islands, 21 endemic species or subspecies of mammals have been identified, with 19 of them being included in the Red List published by the Japanese Ministry of the Environment. In recent years, Japan has completed a significant number of large-scale surveys on natural resources and biodiversity. The Government will continue to carry out the National Survey on the Natural Environment (conducted since 1973) to monitor current biodiversity conditions in land areas and the status of changes, while trying to improve the promptness of data provision. The “Monitoring Sites 1000” project, begun in 2003, promotes long-term ecosystem monitoring of Japan’s typical ecosystems (forests, Satoyama, inland water areas, coastal areas) through the participation of researchers, regional experts, NGOs and citizens. As of July 2011, 1,013 fixed monitoring sites have been established. The project also carries out the monitoring of the effects of global warming on ecosystems and examines appropriate measures to take, such as the development of ecosystem networks. In addition, a census of rivers and riparian areas has been undertaken to identify the status of the habitats of organisms living in rivers, as has a forest resources monitoring survey of around 15,700 forest sites.

4.3. Applicable models in waste management field in Japan

Kitakyushu and Yokohama Eco-towns: Kitakyushu is one of the Eco town that circulates resource circulation and Eco industries. It consist of 29 industrial plants, 16 research facilities and a waste-to-energy (WTE) plant. The recyclable includes PET bottles, automobiles and electronic home appliances, mixed construction waste, fluorescent tubes and office equipment. All non recyclable residue is processed at WTE plant, which generates 99,870 MWh electricity, meeting all Eco town’s electricity demand and reduces 380,000 tonnes of CO_2 per year. In a city level 3R effort the Yokohama G30 plan was launched in 2003. It was targeted to reduce the waste to 30 percent by 2010 compared with 2001 by increasing the separation and recycling of MSW. The category of waste increased from 5 to 10 and in order to encourage citizens to separate their waste at home, around 12,000 meetings held to explain waste separation and 8,300 early morning events were organised to explain about collection centers. The improperly separated waste was left behind with a warning sticker and a non-penal fine of USD 25 was imposed if someone repeatedly failed to separate the waste properly. As a result, the MSW reduced by 42 percent compared with 2001, two incinerator plants were closed permanently and one temporarily, and the city made a cost saving of USD 6 million on waste management.

Osaka Bay Phoenix Centre: In Japan’s Metropolitan regions, such as the Tokyo and Kinki areas where land was densely used, it was difficult to meet the pressing need for stable waste management that arose as a result of an enormous increase in the amount of waste since around the rapid economic development period. The Osaka Bay area was one such area faced with difficulty in securing land for waste landfills. At the same time, in order to develop and enhance port and urban functions in ports in the area it was necessary to create new land by reclamation. As a result, with a view to developing an ocean landfill to ensure proper waste management in districts that require wide-area waste management, the Wide-area Coastal Environment Development Centre Act was enacted in 1981 and the Phoenix Project was launched to create an enormous landfill island in Osaka Bay through cooperation between local and national governments. The Osaka Bay Regional Offshore Environmental Improvement Centre (Osaka Bay Phoenix Centre) was established in 1982 with funds provided by 6 prefectures and 4 port-managing

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corporations. At present, the centre is used for the final disposal of 60 % (425,000 m^3) of the municipal waste generated from the civil activities of approximately 20 million residents of 168 municipalities in 6 prefectures in the Kinki area, as well as 50 % (543 000 m^3) of industrial waste generated from the industrial activities of 900,000 establishments for the shipment of products worth 50 trillion yen.

Incinerator Ash: Disposal of ash is becoming more troublesome and costly due to its toxic nature and increasingly severe restrictions on disposal. Many people are looking for disposal alternatives. A small village in Shikoku has become one of the first towns to utilise incinerator ash to make a saleable product. They have built a plant that utilises the ash, along with cement and a special hardening agent, to make paving stones, cement blocks, parking lot blocks, etc. The plant handles about 10 tons of waste per day which reduces to about one ton of ash. This is mixed with about 200 kg of cement and 18 litres of the hardener and made into the various products. The toxic properties of the ash are neutralised.

4.4. Applicable models for maintenance of sustainable ecosystems and improvement of the soil, air and water in Japan

ENE-FARM: In May 2009, Japanese manufacturers launched ENE-FARM, the first residential fuel cell system in the world. The ENE-FARM system, which runs on natural gas (or propane in some versions), can provide 60 percent of the electricity needed for a household of four and saves USD 500–600 a year on energy costs. Several manufacturers and major energy companies market it jointly. The market has grown exponentially. By early 2012, there were more than 20,000 systems in place in, and this was expected to grow to 40,000 units by the end of 2012. Fuel cells at present use energy from conventional sources to derive the hydrogen needed to create electricity by generating a reaction with oxygen. (ENE-FARM systems are connected to the electrical grid, although they can also be connected only to a separate battery.) Some companies are experimenting with microorganisms that generate hydrogen; for example, Sapporo Breweries uses the waste at food-processing plants. Kajima’s fuel cell electrodes are coated with microorganisms that release hydrogen.

Carbon footprint (CFP) labels: In August 2008, the government announced a plan to encourage companies to label their consumer products with CFP labels. The labels appear on everything from detergents and electrical appliances to food and drink. Designed to inspire consumers to cut down their CO_2 emissions, the labels provide details of each product’s CFP according to a uniform calculation that takes into account the manufacture, distribution, and disposal of each product. Although the program is voluntary, as of 2012 many companies had signed on to gain an edge in the growing market for environmentally friendly products. Companies or industry groups develop a product category rule (PCR) for each of their products. They then calculate the footprint of the product relative to the approved PCR and submit it for third-party verification. After receiving verification, a company may use the CFP label on the product and in product promotion.

The Voluntary Action Plan (VAP) on the Environment was launched in 1997 by Keidanren (the federation of Japanese industries). Industries in the Keidanren VAP committed themselves to bringing their GHG emissions below the 1990 levels by 2010. Also businesses not affiliated to Keidanren in the transport, commercial and service sectors have set up GHG emissions reduction plans. Overall, the VAPs cover about 80% of 2007 CO_2 emissions from the industrial and energy conversion sectors, and about 45% of national emissions. Each sector stipulates its own target and emission reduction measures in the VAP in consultation with the government. Many industries set their targets in terms of energy or emission intensities. This means they can achieve their targets even if emissions increase, as happened during the economic expansion phase in 2002-07. The Keidanren’s Evaluation Committee was established in 2002 to carry out independent reviews of the VAP. According to the review of the 2007 results, decreased use of nuclear power and increased production resulted in emissions above the target. In 2007, about half of the assessed industries did not meet their targets. Nonetheless, between 2000 and 2006, overall emissions of participating industries remained below

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the 1990 levels. The review recommended improving the VAP analysis at industry level and ensuring information disclosure.

The Tokyo Metropolitan Emissions Trading Scheme: Tokyo functions as Japan's political, economical and cultural centre, attracting people, companies and government institutions. This has resulted in large CO_2 emissions (56 Mt), which are comparable to those of a country like Norway, for example. The top contributor to CO_2 emissions is the commercial sector (21 Mt), followed by transport (15 Mt) and households (14 Mt). The Tokyo Metropolitan Government (TMG) is committed to reducing GHG emissions in the Tokyo area by 25% from the 2000 levels by 2020. This target is shared among sectors, with larger cuts required in the transport (-40%) and residential (-20%) sectors, and a 10% cut in the business sector. To tackle emissions from the public sector, TMG has implemented a reporting system. The system is based on the approval of five-year emission reduction plans at the government agency or institution level, mid-term reporting and final reporting. Successful government institutions receive an award. The system can be implemented relatively easily since fewer than 1% of these institutions in the metropolitan area emit approximately 40% of the total CO_2. TMG launched its metropolitan cap-and-trade system in April 2010. This set emission caps on some 1 400 buildings and commercial activities, with the aim of decreasing emissions by 6% in 2010-14 and 17% in 2015-19 from the base level (average of continuous three years in 2002-07 period). Participants in the system have several options to achieve their targets; for example, they can offset their emissions by reducing emissions from large sources outside of the Tokyo metropolitan area.

"Cool Biz" and "Warm Biz": This initiative is more a social eco-innovation than a technological one. Business people are invited to wear cool and comfortable clothes that are appropriate for business occasions, shedding ties and jackets. This "Cool Biz" campaign was widely accepted by the majority of companies and people, and it reduced electricity demand during the summer months. It also reduced emissions by 460,000t-CO_2, which represents monthly emissions of 1 million households. Similarly, Warm Biz promotes the idea of "wear more clothes if you are cold, don't depend on the heater"; note that, in Japan, heating consumes 2.5 times more energy than air conditioning.

Trash bags: Onojo City, Fukushima, is an early adopter of a new type of trash bag designed to drastically reduce nitrous oxide emission and eliminate dioxin emission when burned. The new bags, developed by a company in Kagawa, contain a special oxide in the polyethylene base. The oxide reduces NOx emissions by 1/3; stops lead, cadmium and other heavy metals from leaching out of incinerator ash; and prevents the release of dioxin by reacting with chlorides and unburned materials.

Rejuvenation of arid areas through high-molecule film farming method: Shortage of water and soil degradation triggered by climate change affect the stable food supply and food quality. Melboi Inc. developed a high-molecule film farming method called "Imec" that enables the production of highly-nutritious agricultural crops under harsh environment as well as creating jobs for local community. The technology serves as an adaptation measure by contributing to greater economic capacity for stable food supply and stronger production base.

NEW ZEALAND

5. Green practices in New Zealand

New Zealand is a remote island state in the South Pacific Ocean, comprising two main islands (the North and South Islands) and many smaller islands. Since 2000, vigorous economic growth has helped raise the living standards of the small, but increasing, population. People of New Zealand enjoy a very good environmental quality of life, with low air pollution and easy access to nature. Natural resources have been a pillar of this growth, with agriculture, forestry, fishery and tourism accounting for a large share of GDP. The same time, the natural environment is deeply rooted in the

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country’s cultural identity. New Zealand has strengthened policy co-ordination and environmental management and leads the international research effort to reduce GHG emissions and water pollution from agriculture. It has made greater use of market-based instruments to put a price on environmental “bads” such as GHG emissions and landfilled waste, although the use of energy and road vehicles is taxed at relatively low levels.

5.1. Effective approaches and green measures for maintenance of sustainable ecosystems and improvement of the soil, air and water in New Zealand

Measures towards Circular Economy – Auckland becoming a circular city

New Zealand is a small, open and fast growing economy. The highly efficient agricultural sector continues to be a mainstay of the economy and to dominate the country’s exports; it accounted for 7% of value added in 2015, more than three times the OECD average. New Zealand is the world’s largest exporter of dairy products and sheep meat. Dairy and other animal products and meat accounted for about 40% of total goods exports in 2014. Auckland, like many leading cities across the world, is at the beginning of its journey towards circularity. Co-ordinated circular economy action at a city level is still in its infancy. But Auckland is well placed to take a lead. It has a well-proven innovative, entrepreneurial business culture and a highly connected community, including a vibrant and dynamic indigenous culture. Auckland generated 1.646 million tonnes of domestic and commercial waste in 2016. That’s more than one tonne for every Aucklander. This is likely to increase unless a new approach is taken. Estimates suggest population of Auckland will rise with 833,000 more people in the coming decades, putting it at 2.3 million by 2043.

Economic analysis indicates the economic potential for Auckland’s transition to a circular economy could be up to an additional USD 8,8 billion in GDP in 2030. The analysis also indicates that by transitioning to a circular economy the city could reduce carbon emissions (embodied and generated) by around 2,700 $ktCO_2e$ in 2030 across the food, transport and the built environment sectors. Previous analysis of the circular economy in New Zealand has been completed by the Sustainable Business Network. This identified six key drivers to overcome the barriers to this transition. They are:

- Design for a circular economy rather than retrofit solutions;
- Generate demands for circular economy solutions;
- Develop the infrastructure required to support a circular economy;
- Adopt new circular business models;
- Harness new technology, including 3D printing, Internet of Things and Artificial Intelligence;
- Develop the required enabling policy.

Investment and funding signals to business still often favour adherence to the linear economy. It is needed to level the playing field and access targeted investment for circular solutions. Existing ways of doing that include the Waste Minimisation Fund (national), Waste Levy funds distributed by Auckland Council (Waste Minimisation and Innovation Fund), and Callaghan Innovation. In March 2018 the Ministry for the Environment began requesting applicants to the Waste Minimisation Fund highlight how their projects accelerate New Zealand towards becoming a circular economy. There is also a major role for impact investing. This where investments are made on the basis of social and environmental outcomes as well as financial gains. Ensuring this investment sector continues to grow

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and Auckland entrepreneurs can access such investments is crucial. A circular approach is new to many organisations. Couple this with rapid advancements in technology, and a knowledge and skills gap exists. Simple methods of bridging this gap include platforms for sharing knowledge and case studies. The Going Circular category of the 2017 NZI Sustainable Business Network Awards, sponsored by Auckland Council, is an example of both. In its first year it attracted the highest number of entries of any category in the 15-year history of the awards. The online platform and regular learning and networking events of the Circular Economy Accelerator are other examples of ways to bridge the knowledge gap. Engaging with programmers will leverage new digital technology. This is where programmers and other experts tackle specific challenges in limited timescales. This could be facilitated through collaboration with education institutions already engaging businesses such as Unitec's Tech Futures Lab and Auckland University's Centre for Innovation and Entrepreneurship. An example is the Auckland Climathon weekend, involving Vector. An open source approach can enable common knowledge platforms from which businesses can innovate. For example, the sharing economy requires new types of insurance or leases to accommodate multiple, rather than single, users. An open source template would mean innovation can occur through the user experience, avoiding unnecessary administration. Platforms like backofanapkin.co.nz and Simmonds Stewart are used by start-ups and can provide inspiration for how simple and accessible shared templates can be.

SMEs and resource efficiency

New Zealand has an existing range of technologies, knowledge and other tools that can help SMEs pursue greener growth. They include established standards and guidelines for sustainable business practice, and management tools for monitoring and controlling critical aspects of energy use, production and waste disposal. They also include Energy Efficiency and Conservation Authority (EECA) business support grants, and environmental management programmes delivered through various agencies of central and local government, and through the Private Sector. Several subsidised programmes have been run in recent years to boost SME uptake of good environmental management practices. In addition, New Zealand has a network of 14 Regional Business Partners which are a first point of contact for businesses seeking government assistance for their growth. The partners work with local businesses and government agencies, to provide a range of advice and access to funding and support. There are a range of tools and schemes available to SMEs wanting to improve environmental performance. These range from free self-help tools to comprehensive environmental management consultancy services and scientific investigations into the lifecycle of products. Free options tend to be information resources or web-based selfassessments (e.g. Envirostep, Homestar, LeanStep), although some local councils provide site-specific advisory services focusing on waste, water and energy (e.g. Target Sustainability). There are also many proprietary schemes available on a user-pays basis, where consultants help SMEs to assess their energy efficiency (e.g. SMARTweb) or carbon footprint (e.g. carboNZero Small Business), develop environmental management systems (e.g. ISO 14001, Enviro-Mark, EcoWarranty, EWoF) or improve their sustainability profile (e.g. Get Sustainable Challenge, Green Fleet). There are also many environmental credentials available to SMEs (e.g. ecolabels, management system certifications and reporting schemes), which they can use to communicate their environmental performance to others.

Maintaining and restoring ecosystems and their services

Due to its geographic location and its natural history (which evolved in the absence of mammalian predators), New Zealand has a unique wealth of biodiversity, with one of the world's highest rates of endemic flora and fauna species. New Zealand's biodiversity has been identified as some of the most distinctive in the world. New Zealand is home to approximately 80,000 species of native animals, plants and fungi, many of which are found nowhere else on Earth. At the same time, New Zealand has one of the world's highest shares of threatened species. About a quarter of native mammals, a third of birds, fish and reptiles and some 60% of native amphibians are threatened; some sources point to even higher risks of extinction. New Zealand is a global leader in pest control methods (e.g. of mammalian predators and invasive weeds). These methods, coupled with specific

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recovery programmes (e.g. offshore island management), have helped improve the population status for certain species. The Predator Free New Zealand 2050 initiative, launched in mid-2016, foresees the establishment of a public-private partnership company to support large-scale predator eradication programmes. The area under environmental protection expanded to reach 32% of New Zealand's territory and 30% of the Exclusive Economic Zone (EEZ), shares significantly higher than in most OECD member countries and well above international targets. Almost half of the terrestrial protected areas fall within the most stringent protection categories according to the international classification, and prioritisation of ecosystems for conservation has improved. However, not all ecosystem types are well represented in the protected area network, and some land with significant conservation value has low legal protection status. The Biodiversity Monitoring and Reporting System provide consistent and comprehensive information about biodiversity across public conservation lands and, with the participation of New Zealand's other biodiversity managers, has the ability to deliver the full New Zealand picture.

- Provide a foundation of sound data to better inform effective management planning and policy development;
- Improve understanding and reporting on the health of New Zealand's biodiversity and trends in ecological integrity;
- Reduce reliance on anecdotal evidence and expert advice by delivering factual evidence to inform decisions and report on progress towards outcomes;
- Improve comparability between projects and allow the assessment of interventions;
- Help to further identify which areas of work should be focused on;
- And help New Zealand to meet national and international reporting requirements.

The system is based on different layers of information that operate at different scales, with varying levels of detail and coverage: Tier 1—Broad-scale monitoring for a national context; Tier 2—Nationally consistent monitoring of managed places and species on land, in freshwater, and in the ocean to report on management effectiveness; Tier 3—Intensive, targeted monitoring for research and evaluation.

Terrestrial protected areas

Terrestrial protected areas have increased by 15% since 2000 and covered almost onethird of New Zealand's territory in 2014 (85 000 km^2). Almost half of these areas fall within the most stringent categories of protection of the International Union for Conservation of Nature (IUCN) (i.e. nature reserve and wilderness areas, and national parks), and prioritisation of ecosystems for conservation has improved. The Department of Conservation (DOC) provides extensive tracks, huts and other infrastructure within protected areas (public conservation land), many of which host natural attractions and spectacular landscapes. Setting a precedent at the international scene, New Zealand granted legal personhood to a protected area in 2014 as a key part of the Treaty of Waitangi settlement negotiated between Tuhoe iwi and the Crown.

Making cities more sustainable

With 86% of the population living in cities and towns, New Zealand is one of the most urbanised countries in the OECD. Its cities feature large open green spaces, generally clean air and good water and waste services. Environmental quality of life in New Zealand cities is relatively high. Cities are relatively green, with large gardens and easy access to natural areas. Within Auckland's urban area, green spaces occupy a quarter of the land. Urban air quality has improved and is generally good compared to many cities in other OECD member countries; average concentrations of fine particulate matter and nitrogen oxides generally meet national standards or international guidelines for air quality. Further, 96% of the urban population is connected to wastewater treatment services. A number of cities started implementing policies to reduce waste generation and encourage recycling, but data limitations hamper the tracking of progress. Many of these pressures are likely to intensify as the population and built-up area grow.

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Investing in transport infrastructure

Transport accounts for the largest proportion of local government spending. In 2013, it accounted for nearly one-third of local government's operating expenditure (17% targeted roading and 13% public transport); and nearly half of Auckland's 2012-22 budget. Transport subsidies are the largest source of central government funding assistance for local government infrastructure. Funding is split into two regimes: the New Zealand Transport Agency finances 100% of state highways and major arterial roads; while it co-finances with local authorities on average half the cost of urban, suburban and rural roads, as well as public transport. This funding scheme provides municipalities with an incentive to opt for state highways – which are effectively free for the council – rather than local roads or public transport. The focus of national transport investment has been on road development, with fewer resources devoted to public and active transport. That said, public transport saw greater investment in the second half of the 2000s, driven mostly by investment in metro rail in Auckland and Wellington. This resulted in greater public transport patronage and helped control congestion, despite population growth and associated increases in demand for road use. Auckland Council proposes major investment in public transport, walking and cycling infrastructure in the Auckland Transport Programme under the Auckland Plan.

Traffic congestion and urban mobility

In the Auckland region, the increase in population has prompted a 25% surge in the total vehicle kilometres travelled since 2000. Investment in the road network has helped accommodate increased road use and maintain congestion levels at roughly the same levels over the 2000s. However, congestion remains high: Auckland is considered to be the second most congested city in Oceania after Sydney, despite its relatively small size. Congestion is estimated to cost Auckland NZD 1.25 billion annually. Alternative transport modes (e.g. public and active transport) increased over the past decade **(Figure 18)**. The level of active transport modes (e.g. walking and cycling) is on the rise in some cities, notably in Wellington (26% since 2000), Auckland (29%) and Dunedin (40%) **(Figure 19)**. Upgrades of the rail network helped increase rail patronage from 2.5 million to nearly 14 million trips per year between 2003 and 2015; total public transport boardings increased by 60% over 2005-15.

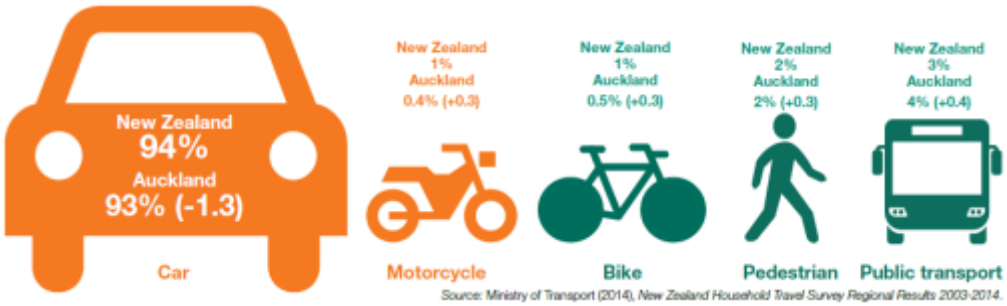

Figure 18. Urban mobility heavily relies on private car use, yet public and active transport is on the rise Mode share of transport by distance travelled, 2012-14. (Change in mode share 2002-04 to 2011-13, percentage points).

With its abundant supply of clean power, New Zealand is well positioned to use electric vehicles, but so far the uptake has been limited. The 2016 Electric Vehicle Programme, which exempts electric cars from the road user charge to stimulate sales, aims to double the fleet every year until 2021. To reach this goal, New Zealand will need to adapt the electricity distribution system and develop infrastructure for charging the vehicles.

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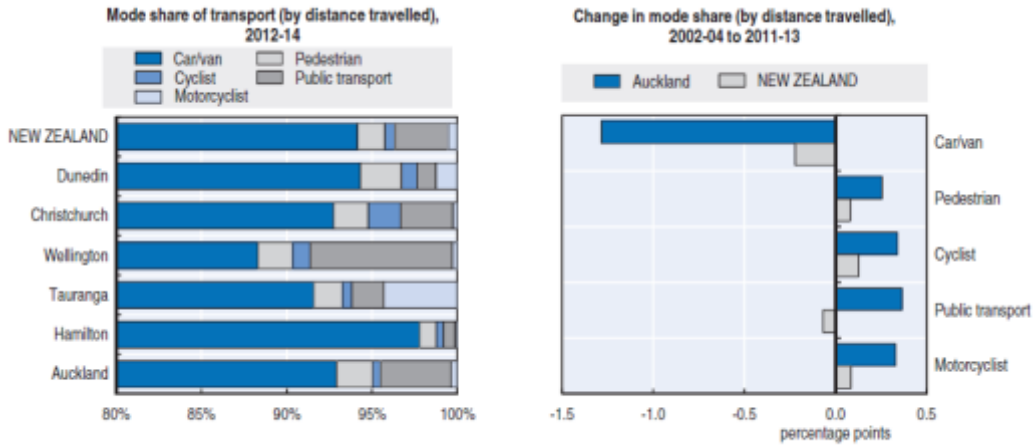

Note: Data refer to main urban areas as defined by Statistics NZ.
Source: Ministry of Transport (2014), *New Zealand Household Travel Survey Regional Results 2003-2014.*

Figure 19. Urban mobility heavily relies on private car use, yet public and active transport is on the rise

Air quality

With increasing road transport, industrial production and power generation, emissions of some major air pollutants (nitrogen and sulphur oxides, and non-methane volatile organic compounds) rose over 2000-14, although at a lower rate than GDP and population growth. Nonetheless, air quality has generally improved, owing mainly to a shift from wood to electricity- and gas-based home heating; national wood burner emission and efficiency standards, and the replacement of older wood burners; improved building insulation; and the introduction of standards for vehicle fuels. Air quality is generally good by international standards **(Figure 20)**, even though short-term air quality standards are breached near busy inner-city roads and in areas with high concentrations of wood burners. New Zealand has improved the monitoring of particulate matter (PM10) pollution, but fine particulate matter (PM2.5), which has greater health impacts, is still monitored at only a few sites in major cities. Most of the air quality standards, which are part of the 2004 National Environmental Standards (NESs) for Air Quality, follow the guidance of the World Health Organisation. However, New Zealand has no national standards on PM2.5 concentrations.

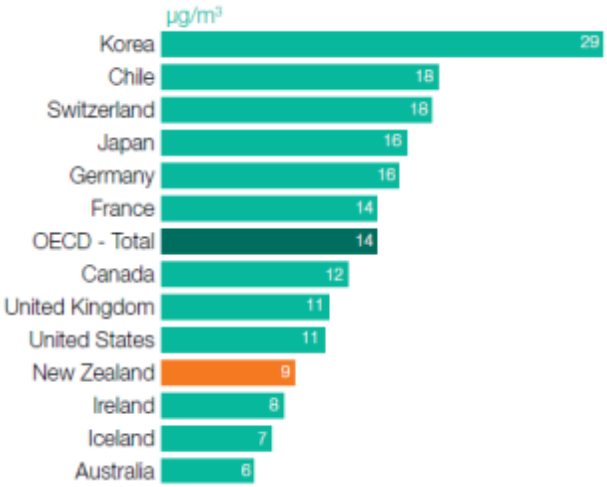

Figure 20. Annual average population exposure to PM2.5, 2013, Source: Environmental Performance Reviews New Zealand Highlights

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Green House Gas Emissions

New Zealand has an unusual emissions profile, with nearly half of its emissions coming from agriculture **(Figure 21)**. Most of the agriculture-related emissions are biological emissions, mainly methane (CH_4). Overall, methane and N_2O emissions from all sources contribute 54% of total emissions. Transport, mainly on roads, is the second largest emitting sector; it accounts for 17% of emissions.

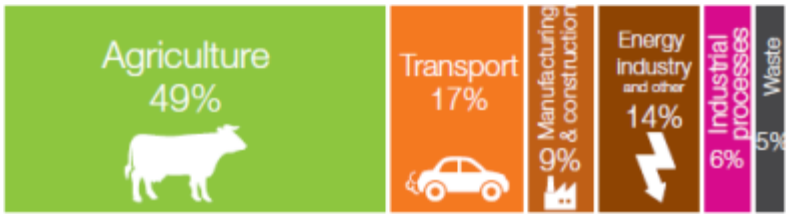

Figure 21. GHG by sector, Source*:* "GHG emissions by source", OECD Environment Statistics (database)

GHG emissions have continued to rise: by 2014, gross emissions (i.e. excluding land use, land-use change and forestry, LULUCF) had increased by 6% from 2000 levels and by 23% from 1990 levels. The LULUCF sector contributed to removing more than a third of New Zealand's GHG emissions in 2000-14. However, removals have declined in recent years as more planted forests have reached harvest maturity (MfE, 2015). In 2014, taking into account emission removals from LULUCF, net GHG emissions were more than 20% above 2000 levels and about 54% above 1990 levels. Despite the increasing waste generation, emissions from waste management decreased, owing to better management systems of landfilled waste (improved methane recovery). Under the Kyoto Protocol, New Zealand committed to reducing its average annual net GHG emissions over the first commitment period (2008-12) to 1990 levels. Despite the increase in gross GHG emissions, the country over-achieved its Kyoto Protocol target by using its forest sinks and international carbon credits. New Zealand did not make a commitment for 2013-20 under the Kyoto Protocol, but it set an unconditional target to reduce emissions by 5% below 1990 levels by 2020, as well as a long-term target of a 50% emission reduction below 1990 levels by 2050. Projections indicate New Zealand is on track to meet the 2020 target, using a combination of forestry removals, domestic abatement and the surplus Kyoto units acquired during the first commitment period. In preparation of the 2015 Paris Climate Conference, New Zealand announced its intended nationally determined contribution (INDC) to reduce GHG emissions to 30% below 2005 levels by 2030. This is equivalent to a reduction of 11% with respect to 1990 levels. New Zealand intends to achieve the 2030 target through a combination of domestic mitigation actions, emission removals from forestry and purchase of international carbon credits. A few other measures are in place to promote energy efficiency; use of renewable energy; and reduction of emissions from transport, including voluntary energy performance standards for building, fuel economy labelling for vehicles and tax incentives for electric vehicles. In the agriculture sector, mitigation options have focused on increasing the productivity per animal and overall efficiency of farms, as well as on investment in research in new technology to reducing biological emissions. The New Zealand government, in co-operation with the business sector, has launched several initiatives to develop and bring to market innovative products and services that can reduce GHG emissions from agriculture. Investment has focused on microbiology, nitrification inhibitors, genomics, animal nutrition, genetics and farm systems. These initiatives have consolidated the country's competitive advantage in technology for climate change mitigation in agriculture and the food industry, as well as in biotechnologies. On a multilateral level, New Zealand led the establishment of the Global Research Alliance on Agricultural Greenhouse Gases, which groups 46 countries to encourage international co-operation and investment.

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5.2. Green practices for maintenance of sustainable ecosystems

Promoting Eco-Innovations

New Zealand has a well-developed innovation system and a sound skills base. In line with an increased emphasis on innovation as a driver of economic growth, public investment in science and innovation has increased by 60% since 2007-08. However, gross domestic expenditure on R&D has remained low at about 1.2% of GDP, about half the OECD average. Public institutions, mostly universities and Crown research institutes, conduct most of the R&D. Despite close co-operation between industry and public research, the number of patents is relatively small, and commercialisation of public research results could be improved (OECD, 2014). The government is the main source of funding for environmental research. Environment-related R&D accounts for nearly 10% of government R&D outlays **(Figure 22)**. This is the highest share in the OECD, but has declined from about 18% in 2007. The share of total energy R&D budget dedicated to renewables and energy efficiency has progressively increased; it exceeded 70% in 2014, although public funding for energy R&D is limited and should be raised. This has contributed to a steady increase of the number of patent applications related to climate change mitigation technology, a trend observed in many other countries and driven by global climate mitigation commitments. Overall, environment- and climate-related technologies made up nearly 12% of all patent applications in 2010-12, in line with the OECD average and more than three times the level in 2000. New Zealand has consolidated its technology specialisation and competitive advantage in climate change mitigation technology in the agriculture and food industry, as well as in biotechnologies, which is second only to Denmark (OECD, 2015e).

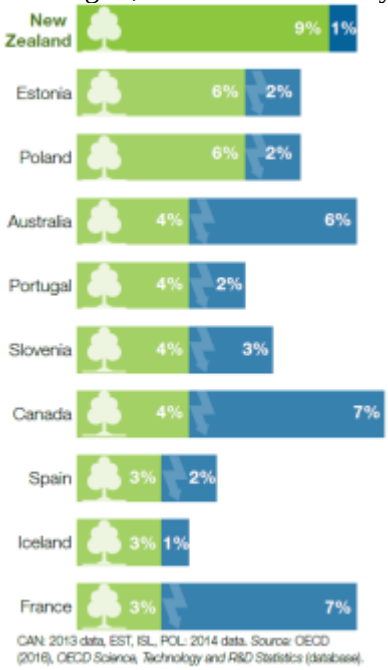

Figure 22. New Zealand had the highest share of public R&D budget to the environment

Sustainable Government Procurement Project

The Sustainable Government Procurement Project, launched in 2006 by the government of New Zealand aimed to provide targets and minimum environmental standards, tools, templates and training to public procurers creating a common understanding about green procurement. As a result of its implementation, standards, guidelines and targets have been set. In particular, a number of priority categories have been designated and the minimum sustainability criteria have been defined. Standards have been developed for four priority categories: paper (recycled content, duplexing etc), timber and

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wood products (legally sourced and sustainably produced), travel (motor vehicles, air travel/video conferencing) and light fittings. The green procurement policy for motor vehicles is a good example as it is based on the 3 pillars of sustainability: Environmental (reducing emissions); economic (vehicle maintenance); social (vehicle safety and driver behavior). Through the implementation of the Sustainable Government Procurement Project public administration aims to accelerate the adoption of sustainable practices in public procurement in areas of greatest impact in New Zealand.

Renewable electricity towards 90%

In 2008, the New Zealand government introduced a target of 90% renewable electricity generation by 2025. It remains an energy policy objective of the national government which receives broad public support. The government expects that the target is likely to be met from the country's very favourable renewable resources base given the attractive economics of renewables resources compared to thermal options. There is no direct government intervention or financial support to help achieve the 90% renewable electricity target for 2025. The government expects that the market should be able to deliver the needed renewable generation capacity without financial support as renewables can provide some of the least-cost options for new generation. In 2015, renewable energy made up 80.2% of electricity generation in New Zealand. Despite annual fluctuations of hydro availability (because of changes in rainfall patterns, the contribution of hydro has decreased in recent years), the proportion of renewable electricity has increased in the past ten years, up from 72.1% of total generation. The high levels of renewables are largely based on a legacy of hydro investment and development, and recent rapid growth in geothermal generation (where New Zealand leads other International Energy Agency (IEA) countries with 15% of generation and 1 137 megawatts (MW) of capacity), which has displaced baseload natural-gas and coal plants. This has been accompanied by low levels of wind and biomass generation, and recently by a small increase in distributed solar photovoltaic (PV).

5.3. Applicable models in the field of waste management

Pay more, throw less: Auckland's waste management system was fragmented across seven local authorities, with different charging schemes. The average waste charges in New Zealand cover just half of an average council's expenditure on waste management. In a welcome step, the first Auckland-wide Waste Management and Minimisation Plan was adopted in 2012. It introduced a coherent funding model based on the polluter pays principle. Households are charged by volume of unsorted household waste, encouraging them to recycle as much as possible. Data show that districts applying the polluter pays principle cut down on waste sent to landfills by nearly half compared to districts that charge flat rates.

New Zealand Packaging Accord: The Packaging Council of New Zealand and the Ministry for the Environment have brought together brand owners, retailers, importers, manufacturers, recyclers and local government to negotiate a New Zealand Packaging Accord. The Accord is a voluntary industry and government initiative which sets targets aimed at making more sustainable use of packaging in order reduce its life-cycle impacts. It is in particular aimed at reducing waste while improving the efficiency along the chain of manufacturing, use and recovery of packaging materials. Producers (brand owners and retailers/importers) will take responsibility for what happens to their

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packaging products throughout their lifecycle - from manufacture to use, to recycling and eventual disposal. Also involved in this lifecycle are manufacturers of packaging, councils and businesses that collect used packaging material for recycling, and consumers who buy and throw away packaging.

Bio-energy Gateway: This is a programme to support the use of wood waste as a renewable energy source from businesses. Energy Efficiency and Conservation Authority (EECA) is coordinating the bioenergy initiative of the Government‟s Forest Industry Development Agenda (FIDA) to increase the uptake of renewable energy from the forestry sector. It provides tools, calculator and forums for the business.

http://www.bioenergy-gateway.org.nz/

5.4. Applicable models for maintenance of sustainable ecosystems and improvement of the soil, air and water

Warm up New Zealand: The flagship Warm Up New Zealand programmes had an overall budget of about NZD 420 million (USD 350 million) for 2009-16, offering subsidies to help households improve their insulation and heating. As of 2016, the programmes had retrofitted nearly 300 000 homes, or 20% of the housing stock. However, an estimated 30% of the housing stock remains uninsulated, many of which are rental homes. In 2016-18, Warm Up New Zealand focuses on properties occupied by low-income tenants with priority health needs related to cold and damp housing. In addition, the 2016 Residential Tenancies Amendment Act introduced stricter floor and roof insulation requirements for rented homes. To avoid retrofitting new houses, the government should consider modernising the Building Code; its building standards are less stringent than those of many other OECD member countries.

A legal personality for the park: In 2014, the government adopted the Te Urewera Act, granting legal personality to the national park of Te Urewera. The park now has “all the rights, powers, duties and liabilities of a legal person”. The land remains protected, with public use permitted as in national parks, but maintain their own separate identity. The Te Urewera Board, which governs the park, comprises members of the Ngai Tuhoe (local tribe) and the Crown; this joint governance acknowledges Ngai Tuhoe’s relationship with the lands and cosmology. The board can file lawsuits on behalf of Te Urewera and represent it in court.

Protecting New Zealand’s birdlife: New Zealand’s unique and diverse birdlife had developed in absence of mammalian predators. However, the introduction of invasive mammals represents a major threat. The government has stepped up efforts to reverse the decline of biodiversity, including through fenced bird sanctuaries and landscape-scale pest control. The government has eradicated predators from more than 100 islands, and aims to eradicate all possums, rats and stoats by 2050. The population status of the indigenous kiwi, brown teal, kokako and yellowhead has improved. The Predator Free New Zealand 2050 initiative, launched in 2016, aims to establish a public-private partnership company. It will support the refinement of existing techniques, such as GPS guided aerial application of a toxin known as 1080 (sodium monofluoroacetate). It will also research new techniques, such as self-resetting traps and predator-specific toxins.

An introduction to OVERSEER®: OVERSEER®, a national model for farm-scale nutrient budgeting and loss estimation, is jointly owned by MPI, the Fertiliser Association of New Zealand and AgResearch Limited. The model estimates nutrient flows in a productive farming system as a function of rainfall, land use, soil characteristics and on-farm management practices. It identifies risks of environmental impacts through nutrient loss, including run-off and leaching. Originally developed as a tool for farming to create nutrient budgets, the model has been adapted to overcome barriers that arise from an inability to clearly identify diffuse source polluters. It is recognised as the best tool available for estimating nitrate leaching losses from the root zone across the diversity and complexity of farming systems in New Zealand.

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The innovative Lake Taupo Nitrogen Market: Lake Taupo is New Zealand's largest lake and a UNESCO World Heritage Site. Since the 1980s, water quality has deteriorated due to increasing nitrogen levels from pastoral farming. In response, the government, the regional and district councils, and local Maori communities introduced an innovative cap-and-trade scheme for diffuse source nitrogen emissions. Each farm was allocated an individual nitrogen emission allowance through OVERSEER, a national model for farm-scale nutrient budgeting and loss estimation. Individual allocations were consistent with the overall reduction target of 20% by 2018. Landowners in the catchment can buy, sell and trade allowances, enabling them to increase production or receive direct financial benefits for reducing nitrogen emissions. The independent Lake Taupo Protection Trust was established in 2007 at a significant cost (NZD 79 million). The Trust buys back some allocated nitrogen allowances to retire land and reduce the economic and social impacts; it met its target reduction in nitrogen emissions in 2015. Inevitably, the cap has had negative impacts on farmers. They have less ability to intensify production; land values have dropped; and administration and compliance costs have increased. Yet new ventures are emerging with production of olives, dairy sheep and sustainable beef, as well as reforestation and credible green branding.

Co-governance of the Waikato river: The Waikato is one of New Zealand's longest, most modified and most polluted rivers. The Waikato-Tainui Raupatu Claims (Waikato River) Settlement Act 2010 led to establishment of the Waikato River Authority (WRA). This independent body has five central and local government appointees, as well as a representative from each of the five Waikato River Maori communities. Together they co-govern the Waikato River. This partnership provides a strong platform for a long-term kaitiakitanga (guardianship and protection) approach in water management decisions. The WRA envisions "a future where a healthy Waikato River sustains abundant life and prosperous communities who, in turn, are all responsible for restoring and protecting the health and well-being of the Waikato River, and all it embraces, for generations to come". Co-governance aims to make Waikato River safe for swimming and for harvest of kai (food).

The Land and Water Forum: The Land and Water Forum, established in 2009, brings together a range of industry groups, environmental and recreational non-governmental organisations, Maori communities, scientists and other organisations with a stake in freshwater and land management. The forum's recommendations have been instrumental in the development of the National Policy Statement for Freshwater Management. It held four years of discussions and engagement with stakeholders and made recommendations for three key reform areas: planning as a community; developing a National Objectives Framework; and managing within quantity and quality limits. Despite consensus within the Forum on ways to improve freshwater management, the central government only took up some of its recommendations.

The Sustainable Farming Fund (SFF): The SFF, set up in 2000, supports community- and industry-driven projects aimed at improving the productive and environmental performance of agriculture, forestry and aquaculture. The maximum total grant available for individual projects is NZD 600 000 over three years. At least 20% of project costs must be met by non-government sources, although most successful projects are able to leverage a high proportion of other funding or in-kind support to complement an SFF grant. The SFF funds a wide variety of projects, including projects focusing on sustainable land management, organic farming, improved water management, climate change mitigation and adaptation and Maori agribusiness. The expected contribution to sustainability or climate change objectives is one of the criteria used to assess applications. The fund has invested up to NZD 9 million per year and backed 948 projects over 15 years.

Cleaner Production: Extensive information on the council of Waitakere‟s Cleaner Production programme is available from their website. Good practice guides are available for a number of sectors including restaurants and cafes, retail, building, printing and sustainable living. The web site hosts best practice projects, a newsletter („Wise Resource Use‟, distributed to around 4,500 local

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businesses to showcase cleaner production initiatives adopted by other local businesses); guidelines for business sustainability.

Verification of technologies: The major initiative in this domain is the Enhanced Eco-verification initiative, which sets out to improve information about standards and certifications relating to reduced environmental impacts of products and firms, facilitate tools to help businesses meet those standards, and enhance systems to verify that the standards have been met.

The Energy Intensive Business (EIB) project: This project, run by the Energy Efficiency and Conservation Authority (EECA), offers cash grants to businesses to help them adopt energy saving technologies. The project is targeted at companies that spend a high portion of their business costs on energy, allowing them to apply for up to 40 per cent of the capital cost of an energy efficiency project (to a maximum of USD 100,000). The grants are designed to pay for projects that include energy efficient technologies such as: high efficiency motors; fans and boilers; variable speed drives; dehumidifier dryers; heat recovery; storage and retention; cogeneration; renewable waste product fuels; industrial refrigeration; fishing technologies; and soil moisture sensing. Examples of initiatives supported by the EIB project include:

- Implementation of a heat recovery system at Tegel Food’s New Plymouth factory (a poultry plant). The system uses waste heat from the plant’s industrial refrigeration system and main air compressor to preheat process water. This looks set to save the company more than USD 110,000 a year in gas and electricity and cut the factory’s CO_2 emissions by over 600 tonnes a year.
- Conversion of a boiler at Christchurch specialty meats producer Verkerks from burning diesel to burn tallow (a meat processing byproduct), which looks likely to cut the company’s energy costs by USD 150,000 a year and has also cut the factory’s particulate matter emissions by 60%.

Acting Globally: A number of the initiatives presented above have an international reach. Typically, Energy Performance Standards are jointly set with Australia. The most notable area of international activity for New Zealand is a considerable amount of cooperation with Australia. The two countries have undertaken a number of joint initiatives, including the Australia-New Zealand Climate Change Partnership. Other bi-and multilateral initiatives are United States-New Zealand Climate Change Partnership; Trade and environment.

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III. EU environmental policies and legislation regarding protection of natural habitats, keeping air and water clean, ensuring proper waste disposal. Best practices in EU - objectives and undertaken measures for implementation of the EU environmental policies. Green practices in the EU - current situation. Recent amendments in local legislations and EU in the field of green practices. National and international environmental policies and legislation.

1. EU environmental policies and legislation regarding protection of natural habitats, keeping air and water clean, ensuring proper waste disposal

1.1. Current legislative developments and EU strategic documents

Principle and legal basis

Articles 11 and 191 to 193 of the Treaty on the Functioning of the European Union (TFEU) are the foundation of the EU's environment policy. Article 11 requires that environmental protection must be integrated into the Union's policies and activities, in particular with a view to promoting sustainable development. Article 191 implements the key legal principles: precaution, prevention and rectifying pollution at source and the 'polluter pays' principle which guide the EU environmental policy. These Articles provide the EU with competences to act in all areas of environment policy, such as air quality and water, waste management, climate change or sustainable development. Article 192(2) requires unanimity in the Council in the fields of fiscal provisions, town and country planning, land use, management of water resources, the choice of energy sources and structure of energy supply. The Treaty of Lisbon introduced competences for the EU to conclude international environmental agreements. The integration of environmental concerns into other EU policy areas has become an important concept in European environment politics. In recent years, environmental policy integration has made significant progress, for instance in the field of energy policy, as reflected in the EU's climate and energy package with combined energy and climate targets or the integration of environmental concerns into the Common Agricultural Policy (CAP).

1.2. EU Environmental Policies

1.2.1. Overarching policies

1.2.1.1. 7th Environmental Action Programme

The 7th EAP Established three thematic priorities for the period until 2020

- To protect, conserve and enhance the Union's natural capital;
- To turn the Union into a resource-efficient, green and competitive low-carbon economy; and
- To safeguard the Union's citizens from environment-related pressures and risks to health andwell-being'.

In addition, it includes four priority objectives for an enabling framework:

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- To maximise the benefits of Union environment legislation by improving implementation;
- To improve the knowledge and evidence base for Union environment policy;
- To secure investment for environment and climate policy and address environmental externalities;
- To improve environmental integration and policy coherence.

Two horizontal priorities address the objectives “to make cities more sustainable” and “to address international environmental and climate challenges more effectively.” The 7th EAP builds on policy initiatives in the Europe 2020 strategy and other strategies in thematic areas, such as the “climate and energy package”, the “Roadmap for moving to a low-carbon economy in 2050”, the “EU Biodiversity Strategy to 2020”, the “Roadmap to a Resource-efficient Europe”, the “Innovation Union Flagship Initiative” and the “European Union Strategy for Sustainable Development”. These strategies include specific targets for 2020 as described below in the respective thematic sections.

1.2.1.2. Sustainable Development

The first sustainable development strategy in the EU was released in 2001. In 2008, the Commission proposed a package of actions and proposals on Sustainable Consumption and Production (SCP) and a Sustainable Industrial Policy Action Plan. These proposals introduced Life Cycle Thinking into European policies. The SCP Action Plan led to initiatives in a number of areas, which are presented below. The review of the Sustainable Development Strategy for the EU (EU SDS) in 2009 focused on mainstreaming sustainable development into EU policies. A key example of this mainstreaming approach is the EU’s Europe 2020 strategy for smart, sustainable and inclusive growth published in 2010. The Commission publishes a bi-annual monitoring report on sustainable development and Eurostat developed Sustainable Development Indicators together with MSs in order to track implementation of the goals. In 2015, the United Nations General Assembly formally adopted the 2030 Agenda for Sustainable Development, along with a set of 17 Sustainable Development Goals (SDGs) and 169 associated targets. In November 2016, the EU adopted a sustainable development package and presented its next steps for a sustainable European future in response to the 2030 Agenda and the SDGs. As part of this package, the EU has committed itself to “fully integrat[ing] the SDGs in the European policy framework and current Commission priorities.” In January 2019, the Commission published a reflection paper “Towards a Sustainable Europe in 2030”, which proposed three scenarios for the future EU policy.

1.2.2. Sustainable production and consumption policies

1.2.2.1. Eco-management and Audit Scheme (EMAS)

EMAS is a management tool enabling companies and other organisations to evaluate, report and improve their environmental performance. In 2001, the scheme was extended from industrial companies to all economic sectors, including public and private services. A 2009 revision of the EMAS Regulation aimed to encourage further registration with EMAS. In 2017, Regulation (EU) 2017/150520 amended the Annexes I, II and III of the EMAS Regulation to include changes associated with the revision of the ISO 14001 standard on quality management systems.

1.2.2.2. Ecolabelling and energy labelling

Labelling aims to provide information to consumers so that they can make informed choices. The European Ecolabel is a voluntary scheme established in 1992 through the Ecolabel Regulation and was last revised in 2010. So far, cleaning products, appliances, paper products, clothing, home and garden products, lubricants and services such as tourist accommodation have received the label. Ecolabel criteria are based on impacts identified in a life cycle assessment. The EU Energy Label established by Directive 92/75/EEC23 guides consumers with regard to the energy efficiency of appliances (white goods). The Energy Labelling Directive was revised in June 2010 to cover a wider group of energy-related products. Regulation (EU) 2017/136925 established new energy labelling requirement for specific product groups. Requirements will be stepped up from 2021 onwards: for fridges, dishwashers, washing machines, TVs and lamps, an A+++ label will be replaced by a B

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categorisation for the same level of energy consumption. Products will need to prove that they are more energy efficient than those classified as B in order to be labelled as A class.

1.2.2.3. Eco-Design

The Eco-design Directive established a framework for setting eco-design requirements applicable to energy-using products, such as boilers, computers and televisions. It aimed to foster the technical improvement of products. A 2009 revision extended the scope of the Directive to products with an indirect impact on energy consumption such as water-using devices, windows and insulation material.

1.2.2.4. Green Public Procurement

GPP is a voluntary policy whereby public authorities opt to purchasing products, services and works with a better environmental performance and reduced negative impacts. The first two Directives referring to public procurement were adopted in 2004. Three Directives were adopted in February 2014 as part of the reform of public procurement under the Single Market Act. These Directives aim to simplify the relevant procedures by improving the conditions for business to innovate and encouraging wider use of green public procurement. To date, 21 sets of GPP criteria have been published for selected sectors such as transport, office IT equipment, cleaning products and services, construction, thermal insulation, and gardening products and services. MSs implement GPP through National Action Plans.

1.2.2.5. Ecco-innovation Action Plan (EcoAP)

The EcoAP was introduced in 2011 and aims to enhance the development and deployment of environmental technologies and to make the EU more competitive in this regard. The concept for a circular economy recently incorporated a number of EcoAP goals.

1.2.3. Resource efficiency, the circular economy and waste management

1.2.3.1. Resource Efficiency

The “Resource efficient Europe” is one out of seven flagship initiatives of the Europe 2020 strategy. As stipulated by the flagship, the EC published the “Roadmap to a Resource Efficient Europe” in 2011 “to define medium and long term objectives and means needed for achieving them”. The objective is to achieve a shift towards sustainable growth, to use fewer resources for the same production levels and to move towards a circular economy where resources are recycled and re-used. Therefore, resource efficiency, the circular economy and waste management practices are strongly interlinked. The roadmap builds on the earlier 2005 Thematic Strategy on the Sustainable Use of Natural Resources.

1.2.3.2. The Circular Economy

In 2015, the EC presented the Circular Economy Action Plan, which “includes measures that will help stimulate Europe's transition towards a circular economy, boost global competitiveness, foster sustainable economic growth and generate new jobs”. The Plan identifies the priority sectors plastics, food waste, biomass and bio-based products, critical raw material and construction and demolition. Furthermore, it includes a comprehensive work programme with a detailed time schedule for 54 actions covering the whole cycle: from production and consumption to waste management and the market for secondary raw materials. In 2018, the EC adopted a monitoring framework for the circular economy, allowing policy makers to identify good practices and prioritise areas requiring further action. The EC adopted a report on the implementation of the Circular Economy Action Plan36 in March 2019. It states that all 54 actions of the plan have been completed and work on some will continue beyond 2019, e.g. actions on eco-design, product reparability, premature obsolescence, quality standards for sustainable chemicals and for secondary raw material, marine litter and food waste. In 2018, the revised legislative framework on the circular economy adopted amendments to Directives on waste, packaging and packaging waste, on the landfilling of waste, on end-of-life vehicles (ELVs), on batteries and accumulators and on waste electrical and electronic equipment40 and included the following central aspects:

- An EU target to recycle 65% of municipal waste by 2035 (55% by 2025 and 60% by 2030);
- An EU target to recycle 70% of packaging waste by 2030;

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- A binding landfill target to reduce landfill to a maximum of 10% of municipal waste by 2035;
- A ban on the landfilling of separately collected waste, requiring separate collection forbiowaste by 2023 and for textiles and hazardous waste from households by 2025;
- The promotion of economic instruments to discourage landfilling;
- Simplified and improved definitions and harmonised calculation methods for recycling ratesthroughout the EU;
- Concrete measures to promote reuse of materials among industries;
- Mandatory extended producer responsibility schemes for producers to put greener productson the market and support recovery and recycling schemes (for packaging, batteries, electricand electronic equipment and ELVs, for example).

Finally, the 2018 EU Strategy for Plastics in a Circular Economy confirms that all plastic packaging should be designed to be recyclable or reusable by 2030. The strategy aims towards enhancing plastic recycling, reducing littering of plastic waste, addressing the plastics value chain and taking advantage of global action. The Council and Parliament decided in 2018 to restrict certain single-use plastic products. Accordingly, single-use plastic cutlery, plastic plates and straws, food and beverage containers made of expanded polystyrene and cotton bud sticks made of plastic are prohibited from 2021 onwards. PET beverage bottles are required to contain a minimum of 25% recycled plastic from 2025 and of 30% recycled content from 2030 onwards.

1.2.3.3. Waste management and prevention

Waste legislation in the EU started more than 40 years ago with the Directive on toxic and dangerous waste and has since then led to a considerable amount of legislation. The more recent developments are described above under “circular economy”. Earlier Regulation includes the 2006 Waste Shipment Regulation, which prohibit exports of hazardous waste to countries outside the OECD and exports of waste for disposal outside the EU/European Free Trade Association. A 2014 amendment of the Waste Shipment Regulation addressed the issue of illegal waste shipments inter alia by enhancing inspections. A number of additional directives and regulations in the EU address specific waste types:

- Directive 86/278/EEC on the protection of the environment, and in particular of the soil, when sewage sludge is used in agriculture;
- Directive 96/59/EC regulates the controlled disposal of polychlorinated biphenyls (PCBs)and polychlorinated terphenyls (PCTs) and of equipment containing these substances with the aim of eradicating them entirely;
- Directive 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS)48 aimed at protecting the environment and health from the use of six hazardous materials found in electrical and electronic products;
- Directive 2011/65/EU known as RoHS-Recast or RoHS 2 required RoHS compliance for CE marking of products while Directive 2015/86350 known as RoHS 3 added four additional restricted substances (phthalates) to the list of six and specified maximum levels in products for the restricted substances. In 2017, a further modification of the RoHS Directive was adopted to enable secondary market operations and allows the use of spare parts for electronic and electrical equipment.

1.2.4. Air quality

Air quality in Europe has improved in recent decades due to joint efforts by the EU and national, regional and local authorities. Directive 2008/50/EC on ambient air quality set limits for the main air pollutants (sulphur dioxide, nitrogen dioxide, oxides of nitrogen, (fine) particulate matter, lead, benzene, carbon monoxide and ozone). The Clean Air Programme for Europe started in 2013 and aimed to promote compliance with EU law by 2020 and with new air quality targets up to 2030. The revised National Emission Ceilings Directive mainly supports this aim by tightening the limits for the five key pollutants and obliges MSs to establish national programmes to control air pollution. In

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addition, a new Directive to diminish air pollution from medium-sized combustion plants resulted from the programme. Industrial installations need to fulfil specific standards to prevent the pollution of water air and soil in accordance with the Directive (EU) 2010/75 on industrial emissions. In 2018 the Commission came forward with the Communication “A Europe that protects: Clean air for all”, which outlined measures available to help MSs fight air pollution and set into motion more high level national Clean Air Dialogues. To address pollution from road transport, a number of Directives define emission performance standards for different types of vehicles and set standards for fuel quality. Currently, for cars and light vans Euro 5 and Euro 6 emission standards define maximum emission quantities for air pollutants, specifically nitrogen oxides and particulate matter. In response to the “dieselgate” scandal with the employment of software to manipulate NOx emissions, new cars need to undergo a test for ascertaining “Real Driving Emissions” (RDEs) since 2017 and cars and heavy-duty vehicles are required to fulfil a number of other new standards. Additionally, a temporary committee investigating the measurement of emissions in the automotive sector has been calling for accountability of MSs and car manufacturers and for retrofitting or pulling out highly polluting cars from the market. Furthermore, a new regulation on type approval and market surveillance of motor vehicles aims to more closely monitor technical services and the compliance with standards for authorised vehicles from 2020 onwards. Caps on the sulphur content of marine bunker fuels are in place to reduce air pollution from ships in accordance with standards agreed by the International Maritime Organisation (IMO). Non-road mobile machinery (e.g. bulldozers, chainsaws or excavators) as well as tractors employed in agricultural and forestry activities and recreational craft (e.g. sport boats) are also subject to emission performance standards.

1.2.5. Chemicals and pesticides

The environmentally sound management and safe use of chemicals is the focus of EU chemicals legislation. The regulations on Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) and on Classification, Labelling and Packaging of substances and mixtures (CLP) are the key elements of this legislation. However, specific groups of products such as biocides, pesticides, pharmaceuticals or cosmetics are covered by their own legislation. In addition, legislation in the waste sector also includes restriction for hazardous chemicals.

1.2.5.1. Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)

The REACH Regulation entered into force in 2007 and established a new legal framework for all chemicals with regard to their development and testing, production, introduction on the market and use. Henceforth, companies were responsible for assessing the risk of substances instead of public authorities. The European Chemicals Agency (ECHA) manages the implementation and application of REACH.

1.2.5.2. Classification, labelling and packeing

Regulation (EC) No 1272/2008 aligned the EU system on the CLP of substances and mixtures (CLP) with the UN Global Harmonised System so that the same criteria and labels for classifying chemical hazards are used. The purpose of the CLP Regulation is to ensure a high level of protection of health and the environment, as well as the free movement of substances, mixtures and articles. The Regulation is applicable to all industrial sectors. It requires manufacturers, importers or downstream users of substances or mixtures to classify, label and package their hazardous chemicals appropriately before placing them on the market.

1.2.5.3. Dangerous Chemicals

Regulation (EU) No 649/201264 was geared to enhancing shared responsibility and cooperation in the international trade of hazardous chemicals. It also served to implement the Rotterdam Convention on the Prior Informed Consent (PIC) Procedure for Certain Hazardous Chemicals and Pesticides in International Trade. According to the PIC procedure, countries need to exchange information on toxic chemicals and the importing country has to explicitly agree before the product concerned can be exported.

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1.2.5.4. Pesticides

The EU adopted a Pesticides Package in 2009, which comprises the following legal acts and contents:

- Directive 2009/128/EC65 on the sustainable use of pesticides, targeted towards reducing environmental and health risks while keeping crop productivity constant and enhancing controls on the use and distribution of pesticides. According to the Directive, MSs must adopt national action plans for setting up targets and measures to mitigate the negative implication of applying pesticides for human health and the environment;
- Regulation (EC) No 1107/200966 concerning the placing of plant protection products (PPP) on the market, defining scientific criteria for determining endocrine-disrupting features of biocidal products and plant protection products;
- Regulation (EC) No 1185/200967 concerning statistics on pesticides, defining how information on the annual quantities of pesticides put on the market and deployed in the MSs are to be collected. Discussions about whether to renew the approval of glyphosate have been ongoing since 2015. This prevalent substance is globally used in broad-spectrum herbicides but the International Agency for Research on Cancer (a branch of the World Health Organisation) has suspected it may be carcinogenic to humans. The European Food Safety Authority (EFSA) did not confirm this presumption and the European Commission ultimately re-approved glyphosate in 2017 until 2022.
- Regulation (EU) No 528/201268 on the making available on the market and use of biocidal products (BP) intends to simplify the authorisation of biocides. Authorisation of biocides is limited to specific application areas and is only possible if they are part of a positive list. The most toxic chemicals are prohibited. If a substance is authorised in one Member State, it can be applied EU-wide according to the principle of mutual recognition. The Regulation also foresees a stronger role of the ECHA.

1.2.5.5. Persistent organic pollutants (POPs)

POPs are chemical substances that are resistant to degradation and can negatively affect human health and the environment. Pesticides (such as DDT), industrial chemicals (such as polychlorinated biphenyls or PCBs) and unintentional by-products of industrial processes (such as dioxins and furans) belong to this group of pollutants. The EU has signed the Aarhus POP Protocol to the Geneva Convention on long-range transboundary air pollution and the Stockholm Convention on POPs in order to control the exportation and importation of POPs. Regulation 649/2012 implements requirements regarding the export of POPs. In 2019, the EU adopted Regulation (EU) 2019/1021 as a recast of a previous POP regulation. The act re-defines obligations for reporting on the production and use of POPs and aligns the rules on POPs with general legislation on chemicals. The Regulation calls upon the Commission to limit the sum of those substances in waste at the same level.

1.2.5.6. Endocrine disruptors

Endocrine Disrupting Chemicals (EDCs) can have harmful effects on the body's endocrine system. A Regulation setting criteria for the identification of EDCs in the context of the pesticides legislation was adopted in April 2018. Since June 2018 a guidance document for the identification of substances with endocrine disrupting properties in pesticides and biocides has also been made available by the EFSA and the ECHA. EDCs are also addressed under the REACH Regulation, among others in relation to the criteria for substances of very high concern. The 7th EAP provided for the harmonisation of hazard-based criteria for the identification of endocrine disruptors. Scientific criteria shall help to identify substances with endocrine-disrupting properties under the PPP Regulation (in force since 10 May 2018) and the Biocidal Products (BP) Regulation (in force since 7 December 2017). If a substance fulfils the criteria, it is considered to have endocrine disruptive properties. The PPP and BP legislations only consider endocrine effects where they may affect humans. The REACH legislation, however, associates endocrine disrupting properties with a potential to generate both human and environment impacts. On 7 November 2018, the Commission published a

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communication “Towards a comprehensive European Union framework on endocrine disruptors”. This communication specifies that inter alia others the Commission has taken action over the years “against endocrine disruptors in line with the different requirements laid down in the relevant legislation” with specific provisions for addressing endocrine disruptors having been included in the legislation on pesticides and biocides, in the REACH Regulation, and in relation to medical devices and water.

1.2.5.7. Detergents

With regard to detergents, Regulation (EC) No 648/200470 addresses the biodegradability of surfactants, rules on limits to surfactants, information requirements for manufacturers and labelling of ingredients. Regulation (EU) No 259/2012 was the last amendment to the act, introducing new tests on biodegradability and enhancing their scope. As a response to a report by the European Food Safety Authority (EFSA) on the harmful effects of certain neonicotinoid insecticides, Parliament requested the Commission to pursue measures for preserving bee populations.

1.2.6. Biodiversity, land use, forests and national capital

The Union has agreed to halt biodiversity loss and the degradation of ecosystem services in the Union by 2020, and restore them so far as feasible, while stepping up the Union contribution to averting global biodiversity loss. The 2020 Biodiversity Strategy adopted in 2011 includes six targets: the full implementation of EU nature legislation to protect biodiversity; better protection of ecosystems and greater use of green infrastructure; more sustainable agriculture and forestry; better management of fish stocks; tighter controls on invasive alien species (IAS); and a bigger EU contribution to averting global biodiversity loss. The strategy also defines a long-term vision. The 2017 Action Plan for nature, people and the economy sets out measures for implementing the strategy and enhancing ambition towards meeting the 2020 targets. In the field of natural capital, the Biodiversity Strategy is supported by the EU initiative on mapping and assessment of ecosystems and their services (MAES) and by the development of a natural accounting system for ecosystems and their services. Furthermore, to protect biodiversity, nature and soil, the EP adopted resolutions in 2016 and 2017 objecting to the authorisation of genetically modified organisms (GMOs) and promoting the prohibition of GMO cultivation by MSs.

1.2.6.1. Conservation of natural habitats and species protection

The Habitats Directive established a European network of protected areas, Natura 2000, which comprises “Sites of Community Interest”/”Special Areas of Conservation” designated by MSs, and “Special Protection Areas” on the conservation of wild birds. With a total area of over 850 000 km^2, this is the largest coherent network of protected sites in the world. The Habitats Directive aims principally to promote the conservation of biological diversity while taking account of economic, social, cultural and regional requirements. The amended Birds Directive covers the protection, management and control of (wild) birds, including rules for sustainable hunting. The above mentioned 2017 Action Plan for nature, people and the economy aims to address remaining weaknesses in the Directives’ implementation. The Natura 2000 network is complemented by the EU’s Green Infrastructure Strategy, which aims to enhance networks of natural and semi-natural areas to deliver a multitude of ecosystem services. An EU initiative on to conserve pollinators was adopted in 2018. Tighter controls on IAS are one of the six targets of the EU biodiversity strategy. A key instrument to implement this target is the IAS Regulation. It provides a set of measures, in particular prevention, early warning and rapid response to be taken across the EU in relation to species included on the list of Union concern to counter the growing threat to Europe’s biodiversity, human health and the economy by the introduction and spread of IAS. MSs have to establish surveillance systems and action plans.

1.2.6.2. Land use, soils and forests

As regards of land use, the Commission’s Roadmap to a Resource Efficient Europe sets the target of “no net land take by 2050”. On improving the state of soils, the Commission withdrew the proposal for a Soil Framework Directive in 2014 that would have implemented its Soil Thematic Strategy,

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reacting to opposition from some MSs. The 7th EAP requires that by 2020 land is managed sustainably in the Union, soil is adequately protected and the remediation of contaminated sites is well underway. The EU forest strategy 2014-2020 has eight priority areas and is supported by a multi-annual implementation plan (Forest MAP). Its priority areas include, among others, the protection of forests in a changing climate, promotion of sustainable forest management to mitigate against climate change, the protection of forests and forest ecosystem services, and the conservation of non-EU forests. The Union also supports the aims of halting global forest cover loss by 2030 at the latest and of reducing gross tropical deforestation by at least 50% by 2020 compared to 2008 levels.

1.2.6.3. Marine biodiversity

To protect and conserve the marine environment, the EU adopted a Marine Strategy Framework Directive (MSFD) in 2008, aiming to protect the resource base for economic and social activities related to the EU's seas and to make sure that EU marine waters have a good environmental status by 2020. The MSFD also requires that by 2020, properties and quantities of marine litter do not cause harm to the coastal and marine environment. The Framework Directive has received some methodological amendments in 2017. The EU Common Fisheries Policy (CFP) aims to ensure that fishing and aquaculture are environmentally, economically and socially sustainable. Between 2015 and 2020, catch limits should be set that are sustainable and maintain fish stocks in the long term (i.e., that can achieve maximum sustainable yield). The present CFP took effect in 2014 and runs until 2020. Civil society organisations have assessed the policy as having stopped neither overfishing, nor the negative impact on non-fish marine biodiversity and habitats. The EU's integrated maritime policy includes a framework for maritime spatial planning. It aims inter alia to protect among others, at protecting the marine environment through early identification of impact and opportunities for multiple use of space. Maritime spatial plans need to be established by 2021.

1.2.7. Water protection and management, marine environment

The protection of water resources, fresh and seawater ecosystems, and drinking and bathing water is an important component of environmental protection in Europe.

1.2.7.1. Water Framework Directive (WFD) and specific supporting water directives

For all waters, the EU has set the overall objective of fulfilling the good environmental status in the EU WFD. It sets up a framework for protecting and reducing pollution of inland surface waters, transitional waters, coastal waters and groundwater. Additionally, it aims to foster sustainable water use and mitigate the effects of floods and droughts. More specific directives support the implementation of the WFD:

- The Groundwater Directive provides criteria for the assessment of good groundwater chemical status and criteria for trends in groundwater pollution. MSs are responsible for setting threshold values for pollutants except for nitrates and pesticides (regulated by EU law).
- The Drinking Water Directive lays down quality standards and monitoring procedures for water that is to be consumed by humans. The Commission started a review of the directive in 2018 which was not yet completed.
- The Bathing Water Directive establishes procedures for the monitoring and classification of bathing water and requires the public to be informed of any monitoring. The Commission and the European Environment Agency annually publish a summary report on the quality of bathing water.
- The Environmental Quality Standards Directive defines maximum values for 33 priority substances that may cause harm to the aquatic environment at EU level and eight other pollutants that could cause risks to surface waters. A review extended the list of the substances included and required the Commission to identify those substances that should be monitored in all MSs for future reviews of the list.

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- The Urban Waste Water Treatment Directive amended by Directive 98/15/EC aims to mitigate environmental negative effects of disposal of urban waste water and discharges from industry. It regulates the treatment of urban waste water and sewage sludge. The Directive is currently under evaluation. Currently, approaches to reuse treated waste water for agricultural irrigation as a means to meet water scarcity needs are being discussed.
- The Nitrates Directive has the goal of preventing nitrates applied for agricultural purposes from causing harm to (drinking) waters and of inhibiting damage from eutrophication. It regulates MSs reporting on nitrates, outlines good agricultural practices, defines nitrate vulnerable zones (NVZ), and provides standards for water monitoring and for the establishment of action programmes.
- The EU Floods Directive targets the risks associated with floods with regard to human health, the environment, infrastructure and property. It obliges MSs to undertake assessments for identifying areas at risk as well as to create flood risk maps and management plans related to floods.

1.2.7.2. EU coastal and marine policy

The Marine Strategy Framework Directive aims for the EU’s marine waters to reach good environmental status by 2020 based on MSs strategies, keep up its protection and preservation and to inhibit deterioration. As such, it covers the environmental aspects of the EU’s Integrated Maritime Policy (IMP), which aims to promote sustainable economic development of maritime activities while also protecting the marine environment. It establishes European marine regions in line with the geographical boundaries of the existing international Conventions for Regional Seas.

1.2.7.3. International agreements on regional waters

Four Regional Sea Conventions including MSs and neighbouring countries govern the protection of marine waters in Europe: the OSPAR Convention of 1992 for the North-East Atlantic; the Helsinki Convention (HELCOM) of 1992 on the Baltic Sea Area; the Barcelona Convention (UNEP-MAP) of 1995 for the Mediterranean; and the Bucharest Convention of 1992 for the Black Sea. The 1996 Danube River Protection Convention and the 2009 Convention for the Protection of the Rhine address the protection of EU rivers. The 2009 Strategy for the Baltic Sea Region, the 2010 Strategy for the Danube Region, and the 2014 Strategy for the Adriatic and Ionian Region define priorities for the development of regions around marine waters or river basis with regard to environmental protection, connectivity and increasing prosperity.

1.2.8. Environmental finance

Environmental finance in the EU comes from a range of sources:

- LIFE is the only EU financial instrument exclusively dedicated to the environment;
- The mainstreaming of environmental action into other EU spending instruments, such as the European Maritime and Fisheries Fund (EMFF), the ERDF and the European Agricultural Fund for Rural Development (EAFRD), provide the vast majority of EU financing available for the protection of the environment, although these instruments are primarily focused on other policy priorities.

In April 2019, the European Parliament agreed with the Council on Horizon Europe, the EU’s framework programme for research and innovation for the 2021-2027 period, which will allocate at least 35% of its budget to climate-related research. Climate and environmental research is supposed to receive record funding of EUR 11 billion under the EU’s Horizon 2020 programme. The EUR 77 billion 2014-2020 research and innovation funding programme will dedicate EUR 135 million to the EU’s plastics strategy, EUR 132 million to the development of the next generation of batteries, and EUR 206 million for the clean energy transition. Low-carbon and climate adaptation projects will be supported by a EUR 3.7 billion budget line for 2018-2020, whilst EUR 1 billion has been earmarked for promoting the EU circular economy.

1.2.9. Sustainable finance

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The Commission established a High-Level Expert Group on Sustainable Finance to develop a comprehensive EU strategy on sustainable finance. This expert group published its final report in January 2018. It included eight key recommendations for a sustainable European financial system. These recommendations formed the basis for an action plan on sustainable finance adopted by the Commission in March 2018. The action plan sets out a strategy to further link finance with sustainability. Its key actions include:

- establishing a clear and detailed EU classification system – or taxonomy – for what are considered to be sustainable economic activities. This will create common basis for all actors in the financial system;
- establishing EU labels for green financial products. This will help investors to easily identify products that comply with green or low-carbon criteria;
- introducing measures to clarify asset managers and institutional investors duties regarding sustainability;
- strengthening the transparency of companies on their environmental, social and governance (ESG) policies;
- introducing a 'green supporting factor' in the EU prudential rules for banks and insurance companies. This means incorporating climate risks into banks' risk management policies and supporting financial institutions that contribute to fund sustainable projects.

In May 2018, the Commission adopted a package of legislative measures implementing several actions announced in its action plan. The package includes:

- A proposal for a regulation on the establishment of a framework to facilitate sustainable investment.113 This regulation establishes the conditions and the framework for a unified classification system ('taxonomy') on what can be considered an environmentally sustainable economic activity.
- • A proposal for a regulation on disclosures relating to sustainable investments and sustainability risks and amending Directive (EU)2016/2341.114 This regulation will introduce disclosure obligations on how institutional investors and asset managers integrate ESG factors in their risk processes.
- • A proposal for a regulation amending Regulation (EU) 2016/1011 on low carbon benchmarks and positive carbon impact benchmarks.115 The proposed amendment will create a new category of carbon-related benchmarks, which will provide investors with better information on the CFP of their investments.

The Commission and the EP achieved a political agreement on the regulation on low carbon benchmarks in February 2019 and on the regulation on disclosures in March 2019. In March 2019, the European Parliament also adopted its position on the proposal for a regulation on the establishment of a framework to facilitate sustainable investment with a number of key changes. The review in the Council is ongoing.

1.2.10. Agriculture and environment

The achievement of environment and climate objectives does not solely depend on the implementation of environmental laws, but also requires environmental considerations to be integrated in other policies. This can be illustrated by the Common Agriculture Policy (CAP): given that agricultural land covers approximately half of the Union’s surface, the CAP can significantly contribute to environmental and climate objectives such as halting biodiversity loss, reducing land and soil degradation, ensuring water quality, reducing ammonia emissions, and managing and reducing GHG emissions. Recent reforms of the Common Agriculture Policy have introduced changes to the policy framework in terms of improved coherence with environment and climate objectives. In the 2014/2020 period, the CAP accounted for around 36% of the EU budget.

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1.3. Climate action policies

1.3.1. International climate policy

The EU ratified the United Nations Framework Convention on Climate Change (UNFCCC) in 1992 and the Kyoto Protocol in 1998. Under the Kyoto Protocol the EU adopted the target to reduce emissions by 20% by 2020. In 2015, the European Union ratified the Paris Agreement and communicated a nationally determined contribution (NDC) under the Paris Agreement of at least 40% domestic GHG emission reductions by 2030 compared to 1990.

1.3.2. 2020 EU climate and energy targets

In 2008, the climate and energy package established binding legislation to ensure the EU meets the following targets by 2020:

- 20% cut in GHG emissions compared to 1990
- 20% share of renewable energy in gross final energy consumption at EU level;
- 20% improvement in energy efficiency at EU level.

The Effort Sharing Decision established binding annual GHG emission targets for MSs for the period of 2013–2020. These targets concern emissions from most sectors not included in the EU ETS, such as transport, buildings, agriculture and waste. The national targets will collectively deliver a reduction of around 10% in total EU emissions from the sectors covered by 2020 compared with 2005 levels.

1.3.3. 2030 EU climate and energy framework

In 2018, the EU adopted legislation on the climate and energy framework for the 2021-2030 period implementing the mitigation target of 40%. Key targets for 2030 are:

- At least 40% reduction in GHG emissions (from 1990 levels). To achieve the target the EU ETS sectors will have to cut emissions by 43% (compared to 2005). To this end, the ETS has been revised for the period after 2020. The non-ETS sectors will need to cut emissions by 30% (compared to 2005); this has been translated into individual binding targets for MSs as part of the Effort Sharing Regulation;
- At least 32% share for renewable energy in final energy consumption (binding target);
- At least 32.5% improvement in energy efficiency.

For the first time, the EU’s framework covers both emissions and removals from land use and forests. The LULUCF Regulation sets a binding commitment for each Member State to ensure that accounted emissions from land use and forests are entirely compensated by an equivalent removal of CO_2 from the atmosphere in the sector. This is known as the “no debit” rule.When the agreed EU legislation for 2030 will be fully implemented, it is estimated that EU emissions will be reduced by approx. 45 % by 2030. This is due to the more ambitious energy targets in the renewables and energy efficiency directives which require deeper emission reductions compared to the climate targets. The Governance Regulation implements a transparent governance process to track progress towards the objectives of the Energy Union, including monitoring and reporting rules. The compliance checks for the targets in the non-ETS sectors takes place in 2027/2028 for the 2021-2025 period and in 2032/2033 for the 2026-2030 period. The rules are laid down in the LULUCF Regulation and the Effort Sharing Regulation. MSs are obliged to adopt final integrated National Climate and Energy Plans (NECPs) for the 2021-2040 period. MSs had to submit their draft plans by the end of 2018, which were then assessed by the Commission. MSs must submit the final plans by the end of 2019. Apart from the 32% binding target for renewable energy by 2030, the revised Renewable Energy Directive (RED II) improves the consumer rights to self-consumption of renewable energy producers, and introduced an indicative annual increase of 1.3% for renewable energy in heating and cooling.

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1.3.4. EU ETS

It covers 28 EU MSs plus Iceland, Liechtenstein and Norway and limits GHG emissions from more than 11,000 power stations & industrial plants as well as airlines operating between these countries. The EU ETS covers around 45% of the EU's GHG emissions. In the 2013-2020 period, the cap on emissions for ETS installations is reduced by 1.74% every year. The legislative framework of the EU ETS for the 2021-2030 period (phase 4) was revised in early 2018 to enable it to achieve a 43% reduction in ETS emissions by 2030 compared 2005. The revision increased the pace of annual reductions in allowances to 2.2% as of 2021. The cap on aviation emissions has been constant in the past; in phase 4 it will decline at the same pace as the cap for the stationary sector. In the third phase, auctioning is the default method for allocating allowances. However, the system of free allocation of allowances will be prolonged for another decade and has been revised to focus on industrial sectors at the highest risk of relocating their production outside of the EU. While the number of sectors deemed at risk of carbon leakage has decreased considerably, in terms of emissions over 90% of the industrial sectors will continue to receive 100% of their allocation for free. For less exposed sectors, it is foreseen that free allocation will be phased out after 2026 from a maximum of 30% to zero at the end of phase 4 (2030). In the earlier ETS phase between 2009 and 2012, the number of available allowances exceeded the demand for allowances (related to total emissions in the EU ETS). A surplus of allowances of 2.1 billion accumulated during this period, which resulted in lower prices for emission allowances and limited incentives to invest in clean, low-carbon technologies. In response to this situation, a number of allowances originally planned to be auctioned between 2014 -2016, were hold back. This measure called “backloading” reduced the surplus to around 1.8 billion. As a long-term solution for the surplus, a market stability reserve (MSR) began operating in January 2019. The MSR function in a way that a proportion of the total allowances are placed into a reserve when the number of allowances in circulation is above a certain threshold in order to reduce the surplus over time. Allowances will be released from the reserve if the indicator of allowances in circulation will be below a determined threshold. From 2023 onwards the number of allowances held in the reserve will be limited to the auction volume of the previous year. Holdings above that amount will lose their validity. For several years in the past, the price for CO_2 was below EUR 10, but with these reforms brought forward in 2018 the price has started increasing. Since March 2019 the price of ETS allowances has always been higher than EUR 20 and since beginning of July 2019 increased to price levels above EUR 25 per ton CO_2eq.

1.3.5. CO_2 emissions from vehicles

The Fuel Quality Directive set a target for the reduction of the GHG intensity of transport fuels at a minimum of 6% by 2020 compared to a 2010 baseline. The Fuel Quality Directive applies to petrol, diesel and biofuels used in road transport as well as to gasoil used in non-road-mobile machinery. The Directive also addresses the sustainability of biofuels. The decarbonisation of emissions from transport fuels after 2020, has been integrated in the revised Renewable Energy Directive133 (RED II), MSs fuel suppliers have to contribute a minimum of 14% of the energy consumed in road and rail transport in the form of renewable energy by 2030. In order to be counted towards the overall 14% target and to be eligible for financial support by public authorities, the revised Renewables Directive (RED II) defines sustainability and GHG emission criteria for bioliquids in transport. Additionally, the Directive sets a target for advanced biofuels: their share in final consumption of energy in the transport sector shall be at least 0.2 % in 2022, at least 1% in 2025 and at least 3.5% in 2030 and 1% of biogas by 2025. The Directive set a 7 % cap on the share of first-generation biofuels in road and rail transport, and plans to phase out the use of palm oil (and other food-crop biofuels that increase CO2 emissions) by 2030 through a certification scheme. Part A of Annex IX to the Directive lists the feedstocks that qualify for meeting this target. GHG emissions from passenger cars and light commercial vehicles represent almost three-quarters of all GHG emissions in road transport. Regulation (EC) No 443/2009 established CO_2 emission performance requirements for new passenger

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cars in 2009. The regulation was amended in 2014 and a phase-in concept was implemented for the period after 2020. The average CO_2 specific emission target was set at 130 g CO_2/km (NEDC) by 2015 and at 95 g CO_2/ km (NEDC) by 2021. Several implementing acts set the rules for transforming the regulation to a new CO_2 certification process (WLTP) after 2020. This has become necessary due to poor real-world CO_2 mitigation performance of the regulation. A similar approach was implemented for new light commercial vehicles in 2011. Regulation (EU) No 510/2011 set the average CO_2 emissions target for vans at 175 g CO_2/km by 2017 and at 147 g CO_2/km by 2020. In April 2019, Regulation (EU) 2019/631 was adopted; it includes CO_2 emission performance requirements for new passenger cars and new light commercial vehicles (vans) in the European Union post-2020. The new targets refer to the manufacturers' average emissions in 2021, which have to be reduced by 15% in 2025 and by 37.5% (cars) / 31% (vans) until 2030. Regulation (EU) 2019/1242 established CO_2 emission performance targets for new heavy-duty vehicles for the first time in the EU. The reduction target was set to a 15% (2025 onwards) and 30% (2030 onwards) reduction target compared to a 2019 baseline level. Trucks, responsible for around 70% of CO_2 emissions of heavy-duty vehicles, are required to meet these targets. The Clean Vehicles Directive was also recently revised. It promotes clean mobility in public procurement tenders (purchase, lease, rent or hire-purchase of road transport vehicles, and public service contracts on public passenger transport by road and rail) and thereby intends to raise the demand for clean vehicles. The Directive includes new definitions of 'clean vehicle', based on CO_2 emission standards for light-duty vehicles and on the use of alternative fuels for heavy-duty vehicles. It extends the scope of the directive to a broader range of procurement practices.

1.3.6. F-gas regulation

Since 2015, Regulation 517/2014 aims to control emissions from fluorinated GHGs by setting maximum quantities for placing hydrofluorocarbons on the market for the most important F-gases until 2030. The regulation also prohibits the use of F-gases if alternative with less damaging effects are available and it prevents emissions of F-gases from existing products through checks, servicing and recovery of the gases when the products are discarded. The maximum quantity shall be calculated by applying the percentages defined in Annex V of the Regulation to the annual average of the total quantity placed on the market into the Union during the period from 2009 to 2012. From 2018 onwards, the maximum quantity shall be calculated by applying the following percentages to the annual average of the total quantity placed on the market into the Union during period 2009 to 2012, and subsequently subtracting the amounts for exempted uses (Article 15(2)), on the basis of available data. At the international level, the phase-down of HFCs has been agreed under the Kigali Amendment to the Montreal Protocol which is starting in 2019. For the EU, the phase-down under the Montreal Protocol is less ambitious than under EU internal legislation, however, so far, EU internal rules only define the process until 2030. Additionally, the Directive on emissions from mobile air conditioning systems in motor vehicles prohibits F-gases with GWPs of more than 150 times greater than CO_2 to be used in new cars and vans produced from 2017.

1.3.7. Long term low emission strategy

In November 2018, the Commission presented its "European strategic long-term vision for a prosperous, modern, competitive and climate neutral economy by 2050". Under the Governance Regulation MSs are required to develop national long-term strategies by 1 January 2020, and ensure consistency between their National Energy and Climate Plans (NECPs). The EP's resolution related to the strategy welcomed the inclusion of two pathways aimed at reaching net-zero GHG emissions by 2050 and regretted the fact that no net-zero GHG pathways for before 2050 were considered in the strategy.

1.4. European Green Deal

Commission President-elect von der Leyen proposed a European Green Deal in her first 100 days in office with the following elements:

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- A new EU climate-neutrality commitment for 2050 and an increased EU 2030 emission reduction target to at least 50% by 2030 (up from the 40% currently);
- The objective of an increased the level of ambition of other major emitters by 2021 in international negotiations. Under such condition, the EU should put forward a comprehensive plan to increase the EU's target for 2030 towards 55%. Under the Paris Agreement, 2020 is the year when updated national contributions are expected (and not 2021), but given the US elections in 2020, it may be unlikely that increased ambition in international negotiations can be achieved in 2020;
- A new Just Transition Fund to support industries negatively affected by ambitious climate targets, such as coal and energy intensive regions;
- A Biodiversity Strategy for 2030 that addressed Natura2000, protection of species and habitats, deforestation, land degradation and oceans;
- A zero-pollution ambition policy in relation to air and water quality, hazardous chemicals, pesticides and endocrine disruptors;
- A new Circular Economy Action Plan, including the issue of microplastics;
- A new 'Farm to Fork' strategy for sustainable food. This will cover every step in the food chain from production to consumption, looking at consumer information, food safety, animal and plant health, fisheries and the agri-food sector;
- The reduction of the CFP of the transport sector;
- Tax policies related to climate including a Carbon Border Tax and a review of the Energy Taxation Directive.

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2. Best practices in EU – objectives and undertaken measures for implementation of the EU environmental policies

Objective	Issue	Targets	Measures
CO_2 emissions from vehicles	• Review of the effectiveness of the updated Regulation (EU) 2019/631 in 2023 • Review is also foreseen for Regulation (EU) 2019/1242 (CO2 emission performance of heavy-duty vehicles) in 2022 • Review of Directive 2006/38/EC on the charging of heavy goods vehicles for the use of certain infrastructures („Eurovignette“) as modified by Directive 2006/38/EC and by Directive 2011/76/EU	• Reduce CO_2 emissions from new passenger cars to 95 grams of CO_2 per km in 2021	• No EP resolution published recently
Air quality	• Concentrations of certain air pollutants, especially in urban areas, are above EU air quality standards in most MSs (e.g. ammonia, carbon monoxide, polycyclic aromatic hydrocarbon, dioxin, NOx, SOx)	• Attain emission ceilings and reduction commitments for the main air pollutants SOx, NOx, NMVOCs, NH3 and primary PM2.5 (for the latter, only reduction commitments) • Attain EU Member State and EU emission ceilings and reduction commitments for the main air pollutants SOx, NOx, NMVOCs, NH3 and primary PM2.5 (for the latter, reduction commitments only) • Achieve levels of air quality that do not give rise to significant negative impacts on, and risks to, human health and the environment (in line with the WHO air quality guidelines) • By 2030, substantially reduce the number of deaths and illnesses from air pollution • By 2030, cut the health impacts of air pollution (in terms of premature mortality due to PM and O3) by 52 % compared with 2005 • By 2030, reduce the ecosystem area exceeding eutrophication limits to 35 %	• Review of the EU's Ambient Air Quality Directive to address current implementation gaps • Reduction of transport emissions • Cleaner energy production • Efficient and clean district heating • Reduction of emissions from intensive rearing of poultry and pigs in concerned MSs whose emissions lead to breaching of EU limits
Biodiversity, land use and natural capital	• Unprecedented rate of biodiversity loss at global and EU level and continued pressure on marine and land ecosystems as well as soil • Biodiversity strategy post-2020	• Combat IAS • Protect species and habitats under the nature directives • Maintain and restore ecosystems and their services • Achieve more sustainable agriculture and forestry • Make fishing more sustainable and seas healthier	• Effective integration of biodiversity objectives into other policies • Completion of Natura 2000 networks by MSs and the designation of special areas of conservation • Improve evaluation of protective measures for marine areas

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		• Help stop the loss of global biodiversity • Improve knowledge of pollinator decline, its causes and consequences; tackle the causes of pollinator decline; raise awareness, engage society at large and promote collaboration • Integrate green infrastructure (GI) into key policy areas, improving the knowledge base and encouraging innovation in relation to GI, improving access to finance including supporting EU-level GI projects.	• Alignment of the Post 2020 CAP with biodiversity concerns • Development of a 2030 Biodiversity strategy for the EU with clear targets, a framework to evaluate progress and financial resources to deliver on commitments • Preparatory action for the implementation of the 2030 CBD biodiversity framework • Establishment of new financial mechanisms for biodiversity in the MFF
Chemicals	• Lack of progress on developing a Union strategy for a non-toxic environment • Chemicals are not produced and used in ways that lead to the minimisation of significant adverse effect on human health and the environment	• Improve the protection of human health and the environment through registration, evaluation, authorisation and restriction of chemicals • Develop a strategy for a non-toxic environment • Develop a strategy on pharmaceuticals in water • The use of plant protection products does not have any harmful effects on human health or unacceptable influence on the environment, and such products are used sustainably • Minimise the use/emissions of listed POPs, following addition of a POP to the list • Priority hazardous substances under Directive 2008/105/EC are eliminated from surface waters in accordance with the WFD • Contaminants are not at a level giving rise to pollution effects • Reduce cancers/deaths from workplace exposures to chemicals • Reduce mercury levels in the environment and human exposure and protect human health and the environment from anthropogenic emissions and releases of mercury and mercury compounds	• Development of a Union strategy for a non-toxic environment • Promotion of non-toxic material cycles • Reduction of exposure to harmful substances (e.g. in chemicals in products) • Actions on endocrine disruptors • Legislation on impact of pharmaceuticals on the environment • Regulation for authorisation and use of water, plant protection products and low-risk pesticides • Inclusion of relevant substances of very high concern in the REACH candidatelist by 2020 • Legislative action to ensure that the combination effects of chemicals are effectively addressed in all relevant Union legislation • Enhanced compliance with the REACH Regulation (registration dossiers, accelerate substance evaluation, implementation of final conclusions)
Climate Action	• The EU is likely to miss its key 2030 climate and energy targets unless governments implement further action	• Limit human-induced global temperature rise to well below 2 °C (and pursue efforts to limit the temperature increase to 1.5 °C) above pre-industrial levels — building on the UNFCCC Treaty’s ultimate objective to stabilise GHG concentrations at a level that would prevent dangerous anthropogenic interference with the climate	• Commission to present legislative proposals that raise the level of ambition in line with the updated NDC and the net-zero emissions target, at the latest during the 2022-2024 reviews of the 2030 climate package and other relevant legislation (renewable energy target and energy efficiency target)

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		system • 20 % cut in GHG emissions (from 1990 levels) • 20 % of EU energy from renewable sources • 20 % improvement in energy efficiency • At least 40 % cuts in GHG emissions (from 1990 levels) • At least 32% of EU energy from renewable sources • At least 32.5 % improvement in energy efficiency • A climate-neutral economy: net zero GHG emissions by 2050	• Setting a further interim emission reduction target by 2040 • Strengthen resilience and the capacity to adapt to climate-related hazards and natural disasters in all countries • Integrate climate change measures into national policies, strategies and planning • All Member States are encouraged to adopt comprehensive adaptation strategies • Developed countries will jointly mobilise USD 100 billion annually to address the mitigation and adaptation needs of developing countries
Funding for climate action	• A serious risk 20 % target will not be met and that there has been no significant shift towards climate action in the areas of agriculture, rural development and fisheries. T • Methodological weaknesses of the current tracking method, including the failure of tracking mitigation and adaptation spending separately.	• In autumn 2019, the Commission and the Parliament have to decide on the priorities of the Multiannual Finance Framework (MFF) for the period 2021–2027 • The Commission proposal foresees an increase of the target of EU expenditure contributing to climate objectives from 20% to 25% (2021-2017) (€ 320 billion for EU 27 compared in 2021-2017 compared to € 206 billion for EU 28 in existing budget period • Integrated reporting on adaptation actions be submitted every 2 years instead of every 4 years	• Increase climate-related spending within the MFF to 30% as soon as possible and at the latest by 2027 (EP resolution on the MFF post-2020) • Increase action towards a clean energy transition in the coal regions. EP called for a specific allocation of EUR 4,8 billion for a new ‘Just Energy Transition Fund’ • Orientation of the post-2020 MFF towards sustainable development • Mainstreaming of environmental policy in all funding mechanisms and budgetary lines and a compulsory mid-term revision, following a review of the functioning of the MFF
Resource efficiency, circular economy	• High waste production (esp. plastic waste) and low resource efficiency in the EU. • Von der Leyen proposed a New Circular Economy Action Plan	• Improve resource efficiency • Strive towards an absolute decoupling of economic growth and environmental degradation •	• Strengthen implementation of the Circular Economy strategy • Introduce a minimum standards for recycled content for specific plastic products in the EU • Create a single market for recycled plastics • Reduction of marine litter and cleaning up ocean plastic waste • Prohibition of microplastics and cleaning products by 2020
Sustainable Development	• Lack of a comprehensive EU SDG strategy and insufficient mainstreaming of SDGs into EU policies and initiatives	• Create more with less, delivering greater value with less input, using resources in a sustainable way and minimising their impacts on the environment • Achieve the sustainable management and efficient use of	• Adoption of an integrated and comprehensive EU SD strategy with detailed timelines up to 2030 • Establish institutional structures and a governance framework to mainstream SDGs into EU legislative proposals

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		natural resources	• Anchoring SDGs in the multiannual interinstitutional priorities of the 2019-2025 legislative period • Specific work to ensure sustainable global value chains, food production and consumption, trade and finance • Systematic monitoring of SDG strategy implementation through common indicators and benchmarks In-depth gap analysis of existing policies and their implementation by the Commission in order to identify critical areas of synergies and incoherencies • European Semester process to involve parliament and include a sustainability check • Completion of EU Ecodesign Directive exploration process by the Commission for new requirements on durability, reparability, disassembly, ease of reuse and recycling in new or revised standards
Sustainable finance	• Commission proposal for a regulation on the establishment of a framework to facilitate sustainable investment currently limits sustainable finance to green investments	• Develop a unified classification system (to better define what counts as sustainable finance); develop standards and labels for sustainable financial products (including green bonds); • better integrate sustainability in ratings and research by credit-rating agencies; • change the fiduciary duties of institutional investors and asset managers, so that they more systematically consider sustainability factors and risks in investment processes; • strengthen disclosure responsibilities and accounting rules, so that companies are required to inform investors about sustainability performance and risks; • and assess the possible negative impact of the Basel III regulatory framework on European bank lending, investment and other activities, which are critical for sustainable finance.	• Improve proposed framework to facilitate sustainable investment • Expand use of the taxonomy to a wide range of financial products to mainstream sustainable finance into financial products and services not limited to green investment • Framework to determine the degree of environmental sustainability of investments • Framework to define criteria for when and how an economic activity has significant negative impacts on sustainability • Taxonomy based on harmonised, comparable and uniform criteria and indicators, consistent with existing EU legislation, consider the whole value chain and link to existing legislation on capital markets and sustainability • Include specific criteria with regard to biodiversity • Consideration of transitional measures, supported through technical screening criteria
Waste management	• Waste treatment obligations are not fully met and waste prevention in all MSs is deficient	• 50 %/55 %/60 %/65 % of municipal waste is prepared for reuse or recycled (differing calculation method for the 50 % target) • Reduce landfill of Biodegradable Municipal Waste	• Enhanced waste prevention • Improve separate waste collection --> recycling • Improve implementation of the Landfill Directive • Improve implementation of End of live vehicles

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		(BMW) to 75 %/50 %/35 % of the same waste generated in 1995 • Reduce landfill to a maximum of 10 % of municipal waste generated • Specific targets for collection, recycling and/or recovery of packaging waste, construction and demolition waste, WEEE, end-of-life vehicles, batteries, single-use plastics (incl. market restrictions and requirements for recycled content) • All plastics packaging should be recyclable • Waste generation to decline absolutely and per capita, and reduction and sound management of hazardous waste • Energy recovery to be limited to non-recyclable waste • Halve per capita global food waste at the retail and consumer levels and reduce food losses along production and supply chains, including post-harvest losses	directive • Legislation of food waste (e.g. clarifying definition and setting targets) • The reuse and recycling to be increased to a minimum of 85% by an average weight per vehicle and year from 2015 onwards.
Water	• Less than half of EU surface water bodies are in good status • Inadequate treatment of urban wastewater in many MSs • Nitrates pollution and eutrophication continue to cause problems in many MSs despite recent positive developments in water pollution from intensive agricultural practices	• Achieve good ecological status of all water bodies in Europe • Protect, conserve and enhance freshwater as well as the biodiversity that supports this natural capital • Protect and restore water-related ecosystems, including mountains, forests, wetlands, rivers, aquifers and lakes • Good hydro-morphological status (quality element supporting good ecological status) • Achieve good chemical status of all surface and groundwater bodies • Reducing and further preventing water pollution by nitrates from agricultural sources • Water abstraction should stay below 20 % of available renewable water resources • Protect human health from adverse effects of contamination of water for human consumption • Increase water use efficiency across all sectors and ensure sustainable withdrawals and supply of freshwater • Implement integrated water resources management at all levels, including through transboundary cooperation as appropriate	• Revision of the Drinking Water Directive and inclusion of necessary updates • Further integration of EU’s water objectives into other sectoral policies under the EAP, in particular the CAP.

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3. Green practices in the EU- current situation.

Sustainable development has long been a central policy objective for the European Union, enshrined in its treaties since 1997. The first EU Sustainable Development Strategy, adopted in 2001, set out a single, coherent plan on how to meet the challenges of sustainable development in the EU. In June 2010, the European Council adopted the Europe 2020 strategy, the EU's agenda for growth and jobs for the current decade. The Europe 2020 strategy put forward the three mutually reinforcing key priorities of smart, sustainable and inclusive growth, steered by the European Semester process. For each of the three key priorities, the strategy defined one or more targets in five areas: employment, R&D and innovation, climate change and energy, education and poverty and social exclusion. The work leading up to the adoption of the UN 2030 Agenda for Sustainable Development in 2015 spurred new momentum for policy action in this area, both globally and in the EU and its Member States. In response to the 2030 Agenda, the European Commission adopted its Communication 'Next steps for a European future: European action for sustainability' in November 2016, announcing a two-step approach towards the implementation of the SDGs. The first work stream has been the full integration of the SDGs into the European policy framework and Commission priorities. The second work stream has been a reflection on further developing the EU's longer-term vision after 2020. In this respect, the Commission presented in January 2019 a reflection paper 'Towards a Sustainable Europe by 2030'. The Communication from 2016 also announced a detailed regular monitoring of the SDGs in an EU context from 2017 onwards, which led to the establishment of the EU SDG indicator set (see next section) and the launch of annual EU SDG monitoring reports in November 2017. In spring 2019, the European Parliament and the Council welcomed the European Commission's reflection paper 'as an urgently needed contribution to the debate on a more sustainable future of Europe and the strategic priority setting for the next European Commission'. The von der Leyen Commission has made sustainability an overriding political priority for its mandate. All SDGs feature in one or more of the 'six headline ambitions for Europe' announced in the Political Guidelines. Each Commissioner is responsible for ensuring that the policies under his or her oversight reflect the Sustainable Development Goals, while the college of Commissioners is jointly responsible for implementing the 2030 Agenda. In December 2019 the European Commission presented the European Green Deal — a set of policy initiatives that aim to make Europe the first climate-neutral continent by 2050. The document is accompanied by an Annex that includes a roadmap with key actions to implement the Deal. The European Green Deal is the new European growth strategy that intends to transform the EU into a fair and prosperous society, with a modern, resource-efficient and competitive economy where there are no net emissions of greenhouse gases by 2050 and where economic growth is decoupled from resource use. It also aims to protect, conserve and enhance the EU's natural capital, and protect the health and well-being of citizens from environment-related risks and impacts. At the same time, this transition aims to be just and inclusive. It is also seen as an integral part of the Commission's strategy to implement the 2030 Agenda and the SDGs. The policy initiatives in the European Green Deal, among others, include cuts in GHG emissions, a new circular economy action plan, a Just Transition Mechanism to leave no one behind, building renovations to achieve energy efficiency, a strategy for sustainable and smart mobility, a sustainable food strategy ('Farm to Fork' strategy), a new biodiversity strategy, a zero pollution action plan and a European Climate Pact that will allow Member States, stakeholders and citizens to better coordinate their actions. According to the roadmap, most policy initiatives will be implemented starting from early 2020. With the Commission's Communication on Integrated Product Policy (COM (2003) 0302 final), GPP became part of the European legislative framework. Member States were advised to adopt National Action Plans (NAPs) for GPP by the end of 2006. Up to now, the majority of EU Member States have set up a NAP on GPP. However, the level of transposition of the EU GPP criteria differs between the European Member States. Strategies, platforms and guidance documents have been established to a varying extent at national level.

Circular Economy Package of the EC

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On 2 December 2015, the Commission adopted the Circular Economy Package with the aim to support the transition towards a more Circular Economy in the EU. The Circular Economy Package proposes actions to keep resources within the economy at their highest utility and value at all times while preserving the environment, and to protect the EU's economy against the scarcity of resources, resource price volatility and dependency on non-EU countries for raw material supply. The Circular Economy Package comprises an Action Plan and a legislative proposal. The implementation of the UN 2030 Agenda for Sustainable Development and the G7 Alliance on Resource Efficiency, as well as the achievement of the 2050 vision of 'living well within the limits of the planet' as set out in the European Union (EU)'s 7th Environment Action Programme (EAP) are supported by the CE package as well. In January 2017, the Commission published a first Report on the implementation of its CE Action Plan (COM (2017) 0033 final). The report highlights actions taken, starting in 2016. Several legislative proposals have been drafted such as the proposal on online sales of goods and fertilisers, and initiatives have been launched e.g. by adopting work plans for the Ecodesign Directive or 'innovation deals'. In January 2017, a platform was launched to support the financing of the Circular Economy, bringing together the Commission, the European Investment Bank (EIB), and financial market participants and businesses.

European sustainable procurement network (Procura+)

Procura+ is a network of European public authorities and regions for connecting public procurers, as well as exchanging best practices and acting on sustainable and innovation procurement. The network develops policy/criteria in specific areas related to sustainable procurement in thematic Interest Groups and operates the Procura+ Helpdesk for individual advice and support (PROCURA+ web 2017).

GPP 2020 - Procurement for a low-carbon community

This GPP 2020 initiative aims to support procurement across Europe to achieve the EU's goals of a 20% reduction in GHG emissions, a 20% increase in the share of renewable energy and a 20% increase in energy efficiency by 2020. The initiative was co-funded through the Intelligent Energy Europe programme of the European Commission and more than 100 low-carbon tendering processes focusing on capacity building, training and best practice exchange were funded which directly resulted in substantial CO_2 savings (GPP2020 web 2017).

PPI platform - Public procurement for innovations

The Procurement of Innovation Platform has its legal basis in the revision of the European Procurement Directives which took place in 2014. It is supported by the European Commission and works as a hub for information regarding innovation procurement. The aim is to steer scientific and technological breakthroughs in areas such as health and well-being, food security, sustainable agriculture or clean & efficient energy. The process will be cofunded through the Horizon 2020 fund and support selected groups of procurers in undertaking joint PPI procurement (PPI web 2017).

Sustainable cities and communities in the EU

The EU has achieved significant progress in increasing the quality of life in cities and communities over the past few years, as well as in sustainably managing waste. However, negative trends can be observed in safe and sustainable transport systems, and urban land-take has increased. Between 2014 and 2020 more than EUR 115 billion from Cohesion policy funds, with the lion’s share from the European Regional Development Fund, will have been invested in cities to create better opportunities for sustainable urban mobility, energy efficiency, urban renewal, research and innovation capacity, and economic and social regeneration of deprived communities. Out of these, EUR 17 billion are spent in cities through integrated urban development strategies managed directly by local authorities.

Quality of life in cities and communities

While European cities and communities provide opportunities for employment, economic and cultural activity, many inhabitants still face considerable social challenges and inequalities. Problems affecting the quality of housing and the wider residential area, such as noise disturbance, crime and vandalism, are some of the most visible challenges that cities and communities can face. These can

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have a direct impact on a population's quality of life. The European Handbook for SDG Voluntary Local Reviews, elaborated by the European Commission, gives policymakers, researchers and practitioners a framework to set up Voluntary Local Reviews (VLRs). VLRs are an effective instrument to monitor progress towards the achievement of SDGs through a local monitoring system specifically designed for European cities.

Quality of housing in the EU

In 2018, 13.6 % of EU residents experienced at least one of the following basic deficits in their housing condition: leaking roof, damp walls, floors or foundation, or rot in window frames or floor. This is 2.7 percentage points lower than the share of the population reporting such deficiency in living conditions in 2010, indicating that the perceived quality of the housing stock in the EU has improved. The overcrowding rate has also fallen since 2010, by 2.0 percentage points. However, in 2018, 17.1 % of the EU population were still living in an overcrowded home. Noise disturbance, along with crime and vandalism, can negatively affect the quality of life and housing satisfaction in a residential area. Living in loud, unsafe environments can cause stress and anxiety. In 2018, 18.2 % of the EU population said their household suffered from noise disturbance, compared with 20.6 % in 2010. Crime, violence and vandalism were perceived in their area by 11.5 % of the EU population in 2018, compared with 13.1 % in 2010. The Environmental Noise Directive is the main EU instrument for identifying and combating noise pollution. It focuses on three areas: (a) determining exposure to environmental noise; (b) ensuring that information on environmental noise and its effects is made available to the public; and (c) preventing and reducing environmental noise where necessary, particularly where exposure levels can induce harmful effects on human health, and preserving environmental noise quality where it is good.

Urban population's exposure to fine particular matter

High concentrations of people and economic activities significantly increase exposure to air pollution, which represents a major environmental and health risk and influences the quality of life in cities. Pollutants such as fine particulate matter suspended in the air reduce people's life expectancy and perception of well-being, and can lead to or aggravate many chronic and acute respiratory and cardiovascular diseases. The population-weighted annual mean concentration of fine particulate matter (PM2.5) in urban areas dropped from 17.5 $\mu g/m^3$ in 2012 to 15.0 $\mu g/m^3$ in 2017. While 15.0 $\mu g/m^3$ is below the limit set by the EU from 2015 onward (25 $\mu g/m^3$ annual mean), substantial air-pollution hotspots remain. According to recent EEA estimates, 8 % of the EU urban population were exposed to levels above the EU PM2.5 limit value in 2017. If the more stringent WHO air-quality guideline is considered (10 $\mu g/m^3$ annual mean), approximately 77 % of people living in EU cities were estimated to be exposed to PM2.5 concentration levels deemed harmful to human health.

The degree of urbanisation

Statistics on the degree of urbanisation provide an analytical and descriptive lens through which to view urban and rural communities. Based on the share of the local population living in urban clusters and in urban centres, Eurostat differentiates between the three categories of 'cities', 'towns and suburbs' and 'rural areas' (8). The prevalence of overcrowding in the EU was bigger in cities (18.7 %) than in rural areas (16.7 %) in 2018. One possible explanation for this is that dwellings in rural areas tend to be larger. The EU population living in towns and suburbs experienced the lowest overcrowding rate (15.4 %). The perceived level of noise pollution varies a lot depending on the degree of urbanisation of the area of residence. In 2018, people living in EU cities were more likely to report noise from neighbours or from the street (24.2 %) compared with those living in towns and suburbs (17.2 %) or in rural areas (10.9 %). Similarly, the perceived occurrence of crime and vandalism in cities (17.4 %) was three times higher than in rural areas (5.8 %), and also above the level observed in towns and suburbs (9.2 %).

Sustainable mobility

A functioning transport system is required for people to reach their places of work, education, services and social activities, all of which affect quality of life. Not only the availability but also the type, quality and safety of transport systems are crucial when designing sustainable and inclusive

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cities and communities. Cars are the main means of transport in the EU. The EU aims to improve citizens' quality of life and to strengthen the economy by promoting sustainable urban mobility and the increased use of clean and energy-efficient vehicles. Public transport networks help to relieve traffic jams, reduce harmful pollution and offer more affordable and sustainable ways to commute to work, access services and travel for leisure. Since 2000, the share of buses and trains in total passenger transport has stagnated well below 20 %, accounting for only 17.1 % in 2017. Both long- and short-term trends show that these public transport modes are losing shares (– 0.4 percentage points since 2002 and – 0.6 percentage points since 2012) in favour of passenger cars. This means most passenger journeys in the EU are still undertaken by car. The EU has established guidelines for sustainable urban mobility planning and provides funding for related projects, including through the use of the European Regional Development Fund. Despite good progress since 2000, a slow-down in reducing the level of road fatalities in recent years has pushed the EU off track to meeting its 2020 target. Since most passenger journeys in the EU are undertaken by car, road safety is an important factor for human health and well-being. In 2014, 1.6 % of the EU population reported they had been in a road accident resulting in injuries, and it is estimated that around 135 000 people are seriously injured each year. In 2018, about 64 people lost their lives on EU roads every day. This corresponds to 23 339 people for the entire year — a loss equivalent to the size of a medium town. Nevertheless, the EU has made considerable progress in this respect, reducing road casualties by 23 992 over the past 15 years, which means that around 51 % less people died in road accidents in 2018 compared with 2003. However, the stagnation in the number of road fatalities since 2013 has pushed the EU off its path to reaching its ambitious 2020 target of halving the total death toll on EU roads compared with 2010, when 29 576 people died. Communication 'Towards a European road safety area: policy orientations on road safety 2011–2020', setting the target of halving the overall number of road deaths in the EU by 2020 compared with 2010, and outlining 16 actions. At the 3rd Global Ministerial Conference on Road Safety in Stockholm in February 2020, Sweden presented the Stockholm Declaration which paves the way for further global political commitment, including a new reduction target for 2030. In this regard, the EU has already taken the lead and set itself a 50 % reduction target for deaths and for serious injuries by 2030. This was set out in the new road safety policy framework for 2021–2030 and the strategic action plan on road safety as part of the 2018 'Europe on the Move' package. The EU's long-term goal is to move close to zero fatalities and serious injuries by 2050 ('Vision Zero').

Environmentally friendly modes of municipal waste management in the EU

The 'waste hierarchy' is an overarching logic guiding EU policy on waste, which prioritises waste prevention, followed by re-use, recycling, other recovery and finally disposal, including landfilling, as the last resort. Waste management activities promote recycling, which reduces the amount of waste going to landfills and leads to higher resource efficiency. 47.4 % of total municipal waste generated in the EU was recycled in 2018. Although municipal waste accounts for less than 10 % of total waste generated in the EU, it is highly visible and closely linked to consumption patterns. Sustainable management of this waste stream reduces the adverse environmental impact of cities and communities, which is why the EU has set the target of 60 % of municipal waste in the EU to be recycled by 2030. Sustainable urban development is a cross-cutting objective of the 7th EAP. The Circular Economy Package supports the transition to a stronger and more circular economy in which resources are used in a more sustainable way. The European Green Capital and the European Green Leaf initiatives showcase the EU's commitment to resolving urban environmental challenges. In May 2018 the European Council established legally binding targets for recycling and reuse of municipal waste. EU countries will now be required to recycle at least 55 % of their municipal waste by 2025, 60 % by 2030 and 65 % by 2035.

Environmental impacts

While cities, towns and suburbs serve as a focal point for social and economic activity, if not managed sustainably they risk causing considerable environmental damage. At the same time, large and densely populated cities provide opportunities for effective environmental action, indicating that

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urbanisation is not necessarily a threat but can act as a transformative force towards more sustainable societies. EU progress in reducing environmental impacts of cities and communities is monitored by three indicators looking into the management of municipal waste, waste water treatment and artificial land cover.

Green solutions - Conclusions

The EU and its nearest neighbours stand at a critical juncture. Despite progress in reducing some environmental pressures in recent decades, Europe faces environmental and sustainability challenges of unprecedented scale and urgency, which it cannot successfully address alone. Calls for global action are being made across science, policy and society. The Intergovernmental Panel on Climate Change (IPCC) has concluded that global CO_2 emissions need to be roughly halved during the coming decade to keep global warming to a maximum of 1.5 °C (IPCC, 2018). Global use of resources is projected to double by 2060 compared with current levels (IRP, 2019). The Earth has experienced exceptionally rapid loss of biodiversity and more species are threatened with extinction now than at any other point in human history (IPBES, 2019). Approximately 19 million premature deaths are estimated to occur annually as a result of pollution of the air, soil, water and food globally (UNEP, 2017). The decade from 2020 to 2030 will be of vital importance in determining Europe's opportunities in the 21st century. In response to these challenges, Europe will need to achieve a rapid and fundamental 'transition to a low-carbon, climate-neutral, resource-efficient and biodiverse economy' (EC, 2019, p. 14). That means transforming the key societal systems driving pressures on the environment and climate and impacts on health - notably energy, food and mobility. It also means addressing the use of resources and chemicals across society and protecting biodiversity and ecosystems and their services. This means rethinking not just technologies and production processes but also governance approaches, consumption patterns and lifestyles. The food, energy and mobility systems are crucial sources of GHG emissions and therefore drivers of climate change. They also contribute to diverse forms of pollution, as well as land use change and landscape fragmentation. The food system has particularly far-reaching impacts on natural systems and people's health and well-being, for example through diffuse nutrient pollution. Chemical use across society also results in widespread environmental harm, and there are few safe-by-design alternatives available yet. There are considerable barriers to achieving systemic change at the pace and scale required. People have become acclimatised to negative messages on the state of the environment, leading to inadequate or delayed responses. Some European citizens are becoming increasingly vocal in expressing their frustration at the shortfalls in environment and climate governance. Non-governmental organisations (NGOs) have taken legal action against national governments for not taking sufficient measures to fight climate change. Young people are becoming increasingly engaged and calling on policymakers to act more decisively (e.g. the school strike for climate campaign). In parallel, innovations have emerged rapidly in recent years, for example in the form of clean energy technologies and social innovations such as community energy, mobility and food initiatives. Some cities and regions are leading the way in terms of ambition. Knowledge of systemic challenges and responses is growing and is increasingly reflected in key European policy frameworks. All of these developments are important because they create space for governments to act and bring a new scale of ambition to policy, investments and actions. They also help raise awareness, encouraging European citizens to rethink their behaviour and lifestyles. Fundamentally, the choice in 2020 is straightforward: to continue on a trajectory that puts the environment, future economic development, well-being and social cohesion at risk, or to change trajectory, setting Europe on a strong and credible development pathway to achieve a sustainable future.

4. National and international environmental policies and legislation

4.1. Environmental policies in Denmark

4.1.1. Framework

Since a 2007 reform, Denmark's 98 municipalities have been responsible for most aspects of environmental management. To manage the transition, the country implemented a recommendation in

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the previous OECD Environmental Performance Review (2007) by setting up task forces to help municipalities carry out their new tasks. It also integrated monitoring of national environmental action plans in the National Monitoring and Assessment Programme for the Aquatic and Terrestrial Environment (NOVANA), in line with another recommendation. Finally, it used cost-benefit and cost-effectiveness analysis widely, e.g. based on updated guidelines on socio-economic assessment from 2017.

Institutional framework

Denmark has a decentralised environmental governance system in which jurisdiction on the environment is shared among the national, local and, to a lesser extent, regional levels. The national level sets the legal framework and provides guidance on implementation. It also develops national plans, programmes and strategies. Local authorities are responsible for municipal and local planning; implementation of policies, plans and programmes; and issuance of most environmental permits and related inspection.

National institutions

In 2007, a Ministry of Climate and Energy was established. Previously, climate change had been part of the Ministry of Environment. The rationale for a separate climate ministry was mainly the need to prepare for the 15th Session of the Conference of the Parties to the United Nations Framework Convention on Climate Change, held in Copenhagen in December 2009. The merging of the climate and energy portfolios facilitated reform of energy policy to support climate objectives, as evidenced by the ambitious Energy Agreements of 2012 and 2018. In 2015, economic regulation of Nature Agency manages MEF's approximately 200 000 ha of forests and natural areas. Within the agency, the Danish Coastal Authority is responsible for the protection of 7 300 km of coastline. The Danish Maritime Authority supervises and inspects ships sailing under the Danish flag and provides port state control over health, safety and environmental protection.

Subnational institutions

The Constitution guarantees municipalities the right to decide their own affairs under state supervision. The notion of municipal autonomy has continued to shape the role of municipalities. While the national level provides a budgetary transfer in the form of a block grant, municipalities decide how it is spent. Equalisation between richer and poorer municipalities partly offsets differences in income levels, contributing to capacity in less affluent municipalities. In 2007, Denmark introduced a reform of its local administrative structure. The number of municipalities was reduced from 271 to 98, and 14 counties were replaced by 5 regions. In the process, most county environmental responsibilities were transferred to either the enlarged municipalities or the national level. Regions inherited limited environmental responsibilities, such as handling raw material extraction and contaminated soils. In March 2019, the government decided that these responsibilities would be transferred to the national level. The 2007 Environmental Performance Review of Denmark recommended setting up capacity-building mechanisms to help municipalities carry out new environmental management tasks. The national level has done this by establishing task forces that provide free assistance to municipalities in environmental planning. They have covered areas such as installation of wind turbines and biogas plants, municipal climate adaptation plans, groundwater protection and permitting of livestock farms. The EPA also issues guidance to municipalities on how to implement environmental legislation. Further such guidance could be strengthened by learning from international best practice, e.g. Switzerland's enforcement aids to cantons. To address the recommendation on more inter-municipal co-operation in water and nature management, a joint working group between the national level and Local Government Denmark was formed to support municipalities in this area. The introduction of river basin management has since improved cross-municipal co-operation on water management. In addition, a major initiative on wetlands launched by MEF in 2010 led to grouping of municipalities at the catchment level to ensure cohesion in decision making.

Legal framework

Biodiversity strategy

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Denmark’s national biodiversity strategy is entitled ‘The Danish Nature Policy—Our Shared Nature’. Adopted in 2014, it contains a long-term vision to 2050 and serves as Denmark’s revised national biodiversity strategy and action plan. Since 2016, it has been under revision by the Danish government. On the basis of the latest update on the assessment of The Birds and Habitats directives, Denmark’s terrestrial Natura 2000 network under the Birds and Habitats Directives is now considered to be complete.The Danish government has initiated a procedure to adjust the boundaries of the sites within its Natura 2000 network. This procedure was finished by the end of 2018. The Commission carried out a detailed analysis of the proposed changes. The Danish government has informed the Commission that national initiatives planned in the country’s Nature Package (Naturpakken) include an additional 13300ha of high-nature-value forest in the national forests (owned by the government) and at least 900 additional ha of high-nature-value privately owned forests. Considering that Member States report every 6 years on the progress made under both directives, no new information is available on the state of natural habitats and species, or on progress made in improving the conservation status of species and habitats in Denmark.

4.1.2. Environmental policies regarding natural habitats, keeping air and water clean and ensuring proper waste disposal

In Denmark, green infrastructure is addressed in several national and regional documents that deal with spatial planning. Green infrastructure is also referred to in legislation dealing with nature protection, forestry, national parks and land distribution. Denmark has been recognised and awarded for its efforts to create liveable urban areas in which green infrastructure plays an important role. The Copenhagen municipality has adopted a policy to make trees a greater priority in the city between 2016 and 2025. In addition, the 2016 Nordic Council of Ministers gave a Nordic Built Cities Challenge award to a park in Copenhagen. The award recognised the park’sinnovative useof ‘blue-green infrastructure’ to manage rainwater from cloudbursts in the Hans Tavsens Park in Copenhagen. The Danish government agreed on a package of nature policies in May 2016 and a package of food and agriculture policiesin December 2016.

Environmental Protection Act

The Environmental Protection Act, no. 1757 of 22 December 2006 (updated: No. 879 of 2010; no. 966/2017) last amended in 2017, is the central piece of legislation on prevention and management of pollution in Denmark. It sets general quality requirements for air, water, waste, soil (above and below ground) and noise. The act sets out fundamental environmental protection objectives and the means by which they are to be met. It is a framework act, supplemented by guidelines and statutory orders issued by MEF. A number of businesses, plants and applicants have been listed by The Minister for the Environment on an exhaustive list, meaning that commencing these businesses, plants or appliances requires prior approval.

Environmental Objectives Act

The Environmental Objectives Act, last amended in 2016, governs protected areas, including the management of Natura 2000 areas. Under the act, the environment minister designates internationally protected areas and prepares a plan for each Natura 2000 area. Municipalities are charged with preparing action plans for each area to implement the national plans locally.

Clean Air package

The Danish Government launched a clean air package in October 2018, especially dedicated to reduce air pollution in larger cities and phase-out diesel and gasoline vehicles. Further, it has committed meet the reduction targets under the NEC directive. Concrete objectives include no new diesel or gasoline cars sold by 2030; no hybrid cars by 2035; cleaner transportation in urban and rural areas; more environment friendly shipping at sea and in harbours; an effective and modern agricultural sector; greener residential heating. In Denmark, air quality is the responsibility of the Ministry of Environment and Food and its Environmental Protection Agency (EPA). Danish requirements for air quality are all based on provisions adopted by the European Union. The Danish regulations that set the limit values for polluting substances date from 2010. EPA ensures that the levels of these substances – including sulphur dioxide (SO_2), nitrogen dioxide (NO_2), nitrogen oxides,

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lead, particulate matter, benzene, carbon monoxide and ozone as well as certain heavy metals – are regularly measured. According to the EPA, Denmark usually meets the limit values for most substances. EPA also ensures compliance with the international regulations on air pollution from ships.

Act on Soil Protection

The Soil Contamination Act, last amended in 2016, charges the regions with mapping and managing contaminated soil. It partly transposes the EU directives on environmental liability and industrial emissions. The scope of the Act covers soil which due to human interaction may have a harmful impact on water, human health and the environment in general. A central part of the protection of soil relates to the mapping of the polluted areas which is usually performed by the local authorities. The results of these mappings decide whether the soil may be used for habitation or business, or whether an order should be given. A polluter is obliged to follow an order given by the local authorities. Typically, the order will demand that the polluter cleans the area. The owner of the polluted soil cannot generally be met with a claim to clean the pollution, if the owner is not the polluter himself.

The Climate Act

The Climate Act sets a target to reduce Denmark’s emissions by 70 percent in 2030 compared to 1990 and against climate neutrality by 2050. The UN accounting rules are used to calculate GHG emissions and reductions against the target. The climate council is strengthened and expanded; its funds doubled, and its independence strengthened by self-election of new chairman and members. The Act sets a series of reporting obligations on government, including an annual parliamentary examination of the government’s action towards meeting the targets. Government is required to produce on the impact of its climate policy on Danish imports and consumption. Government must also produce an annual global strategy stating how the government's foreign, development and trade policies ensure Denmark’s role as a global driver in international climate policy. The 2014 Climate Act, established an independent Climate Council charged with evaluating compliance with climate targets, analysing pathways for Denmark to become a low emission country by 2050, issuing recommendations on climate policy and mitigation measures, and contributing to the public debate. The government must respond to the council's recommendations in a yearly climate report to Parliament. The law requires the government to set national GHG reduction targets at least every five years with a ten-year time frame.

Water quality and management

In 2013, Parliament adopted a revised Water Planning Act, transposing the EU WFD and establishing the legal framework for river basin management. It provides for active involvement of civil society in the drafting of RBMPs through municipally managed water councils comprising representatives from environment and agriculture groups. To facilitate their work, the government informs them of the cost-effectiveness of measures that could be implemented in the watershed. Denmark has adopted and reported the second generation of River Basin Management Plans under the WFD and the European Commission has assessed the status and the development since the adoption of the first River Basin Management Plans, including suggested actions in the EIR report 2017. To fulfil its obligations under the Nitrates Directive, Denmark applies mandatory measures on its whole territory. Denmark is changing its legislation towards a more targeted implementation system. Agricultural pressures and the existing water quality issues mean that Denmark must ensure that these changes are accompanied by clear environmental objectives and targets and effective enforcement mechanisms. This will ensure the necessary and timely reduction of nutrient pollution in Danish waters and in the Baltic Sea. Denmark demonstrates excellent levels of compliance with the requirements of the Urban Waste Water Treatment Directive. Significant investment needs still exist in Denmark to accelerate the implementation of the WFD and the Floods Directive, such as the removal of obstacles to fish migration, renaturalisation of the flow of rivers, and various measures for flood prevention and mitigation. Denmark has adopted and reported its first Flood Risk Management Plans under the Directive and the European Commission conducted an assessment. The Commission’s

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assessment found that good efforts were made with positive results in setting objectives and devising measures focusing on prevention, protection and preparedness. The assessment also showed that, as was the case for other Member States, Denmark's Flood Risk Management Plans do not yet include clearly prioritised measures and an as complete as possible estimation of the cost of measures with identification of specific sources of funding. In addition, there is scope for improving the integration of the flood risk management cycle including amongst the various levels of administration.

Act on Chemical Substances and Products

In Denmark, the Chemical Inspection Service at the Danish Environmental Protection Agency is the prime enforcement authority for legislation regulating chemicals. The main legislation regulating chemicals is the Danish Act on Chemical Substances and Products. In addition, chemicals are regulated by statutory orders and EU chemical regulations. Some parts of the regulations are enforced by other authorities.The Chemical Inspection Service conducts enforcement campaigns every year for different chemical substances, products and articles. In addition, the Chemical Inspection Service receives and responds to complaints about chemical products from companies, NGOs, the general public, and other authorities.

Direct environmental regulation

Over the years, Denmark has made extensive use of pricing instruments, such as taxes and charges, and financial support instruments to manage environmental issues. Denmark increasingly favours outcome-based over design-based direct regulation to give producers more flexibility on how to comply. Regulation of excess nutrients from farms is a good example. In 2015, Denmark decided to replace a requirement to establish buffer zones without fertilisers, crops or pesticides along certain streams and lakes with a more targeted regulation giving farmers flexibility on the choice of abatement measures. Similarly, environmental permits for livestock farms require the use of best available techniques, expressed as an outcome level of emissions from farms to the environment. Farmers are free to choose among available techniques or technologies. To improve water quality in a more targeted (i.e. risk-based) way, Denmark is implementing a new policy. For each of its 90 river sub-basins, it has estimated how much excess agricultural nitrogen must decrease for coastal waters to attain good status under the WFD. In parallel, it has estimated the amount of nitrogen retained in soil on the way from farms to coastal waters, based on 3 000 units. By combining the required reduction in each sub-basin with retention rates in soil, Denmark determines the effort that must be made in each of the 3 000 units. Efforts to reduce excess agricultural nitrogen are thus differentiated according to the risk of water pollution (the extent to which each coastal water needs protection) and cost-effectiveness (where abatement measures are most effective). Public financial support is available on request. It is combined with an uncompensated direct regulation backstop mechanism if voluntary participation is insufficient to achieve the required reduction. To ensure cost-effectiveness at farm level, farmers can freely choose among abatement measures whose effect has been documented by Danish universities. An international expert panel found that Denmark had achieved the highest possible standard of WFD implementation with respect to methodology and determination of required actions (MEF, 2017). In 2015, Parliament adopted the Food and Agriculture Package. Consequently, changes have been made to the Fertiliser Act and Animal Husbandry Act to boost food production while respecting environmental legislation by applying a more targeted approach to nutrient pollution mitigation efforts. Growth Plan for Food and a Growth Package‘s purpose is to reduce the time it takes the central government to process files for environmental approvals by 20% and municipal processing time by 33%. The Order on Environmental Permitting, last amended in 2018, covers some 4 400 companies. They must apply for an environmental permit before starting production or significantly changing or expanding their activities. Livestock farms are covered by a separate Order on Livestock Environmental Permitting. It takes into account risks regarding excess nutrients to groundwater, lakes and coastal waters and the adverse impact of ammonia emissions on protected areas, among other matters.

Spatial Planning Act

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The Spatial Planning Act, last amended in 2018, provides a national framework for spatial planning that seeks to balance the need for environmental protection with economic development and growth. Local plans are the most detailed level of spatial planning. They establish rules on how land can be used and developed (OECD, 2017). Municipal plans must address climate adaptation needs and reflect the Green Map of Denmark. A 2017 reform of the act gave municipalities more flexibility to promote growth and development with continued respect for nature and environment. One example is more flexible building opportunities in rural and coastal areas. Amendments to the Spatial Planning Act in 2015 and 2017 introduced requirements for municipalities to plan and designate existing and potential natural areas and wildlife corridors, including existing Natura 2000 sites, on the Green Map of Denmark. The aim of the map is to improve biodiversity by reinforcing efforts to establish larger and more interconnected natural areas and ensure coherence between designations in neighbouring municipalities. The map shows not only existing nature but also where there is a potential to create larger natural areas, such as forests and heaths. The map is continuously developed and expanded as municipalities review their municipal plans every four years.

Environmental Information Act

The Environmental Information Act, last amended in 2017, constitutes Denmark's implementation of the EU Directive on Public Access to Environmental Information, which in turn implements part of the UNECE Convention on Access to Information, Public Participation in Decision-making and Access to Justice in Environmental Matters (the Aarhus Convention). Access to environmental information, to which the act applies, is broader in scope than access to other types of information, which is covered by the Open Administration Act. The time in which authorities must handle requests for information ranges between one to two and forty workdays, depending on the complexity of the request. The Open Administration Act requires national, regional and local authorities to communicate actively about their activities on their websites. Every four years, MEF issues an Environmental Status Report on Denmark's nature and the environment. NOVANA makes national monitoring data available to the public on environmental impacts, status and trends with regard to nature and the environment. Aarhus University publishes a yearly summary of these technical documents as a more accessible supplement.

Environmental Assessment Act

The EU Strategic Environmental Assessment (SEA) Directive was transposed into Danish law in 2004. The resulting Environmental Assessment Act, last amended in 2017, requires ministries to conduct SEAs of plans and programmes that may significantly affect the environment. Examples of SEAs conducted include a SEA of changes to the regulation of fertiliser use by farmers in the Food and Agriculture Package, SEA carried out on building and construction projects before the contractor is granted permission to begin the project and a SEA of the choice of location of marine wind turbines following the 2012 Energy Agreement. The system of political agreements means a SEA is sometimes performed after a political decision is made, in which case implementation can be conditional on the SEA showing compatibility with legal constraints, e.g. EU environmental law. A recent example of a cost-benefit analysis is the government proposal to tighten restrictions on vehicles in green zones in the largest cities, which was included in the 2018 Climate and Air Pollution Proposal and approved later that year. In 2014, MEF tasked academics with preparing an ex ante cost-effectiveness analysis of possible measures in RBMPs for 2015-21 (DCA, 2014). An inter-ministerial working group produced a similar analysis of possible GHG mitigation measures in 2013 (MEUC, 2013), and potential GHG mitigation measures in the agricultural sector underwent analysis in 2018. Cost-effectiveness analysis was also performed in preparation of the 2013 national waste plan and in 2013 and 2014 on implementation of the EU National Emission Ceilings Directive. Denmark conducts ex post evaluation of important policies, plans, programmes and political agreements. For example, an evaluation of the pesticide tax and reduction target was made public in 2018 (EPA, 2018). Energy taxes and support under the 2012 Energy Agreement were also subject to extensive ex post evaluation. The findings fed into preparation of the 2018 Energy Agreement and led, for example, to a commitment to lower the electricity tax. The 2007 Environmental Performance Review

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recommended prioritising monitoring of national environmental action plans. This is now included in NOVANA.

Environmental inspections

Municipalities conduct most environmental inspections, using EPA guidelines. The EPA inspects the most complex companies with the most serious potential impact on the environment. These include energy plants, metal and mineral producers and processors, the chemical industry, shredder waste managers, landfills, hazardous waste managers, and incinerators (Statutory Order No. 1317 of 20/11/2018 on Environmental Permits). The EPA and municipalities jointly oversee imports of waste for treatment. Inspection is governed by a variety of rules and guidelines. Firstly, inspections by the municipalities and by the decentralised units of the Environmental Protection Agency (EPA Copenhagen, Aarhus and Odense) are covered by Chapter 9 of the Danish Environmental Protection and Chapter 5 of the Danish Livestock Approval Act. Parts of the inspection work such as inspections involving wastewater or waste may be covered by other aspects of legislation. The approximately 700 municipal inspectors in Denmark's 98 municipalities conducted around 17 000 environmental inspections in 2017. In 2010, MEF launched its second enterprise committee, whose work resulted in recommendations regarding simplification and updating of the corporate environmental regulatory system. The recommendations led to reorganisation of environmental inspections. Denmark now takes a risk-based approach to environmental inspection, in line with the Industrial Emissions Directive (IED). It assigns a risk score to companies based on five parameters with differing weights: use of environmental management systems (20%), previous rule compliance (30%), storage of chemicals or other hazardous substances (16.5%), emissions to air, soil or water (16.5%) and proximity to environmentally sensitive areas (17%). The potentially most environmentally harmful companies are inspected at least every three years, as the directive requires, while the least potentially harmful are inspected at least every six years. In both cases, the frequency of inspection is increased if the companies' risk score justifies it (Statutory Order No. 1476 of 12/12/2017 on Environmental Inspections). Applying a risk-based inspections system to even the least potentially harmful companies is good practice. Until 2016, each municipality produced a yearly report on its environmental inspections, but these data were not systematically compiled at the national level. In 2016, Denmark introduced a central database collecting data from all inspections. This is a positive step, as it gives an overview of the total number of inspections and violations. The share of companies violating environmental rules is not known, as several violations may be found in a single inspection. The numbers suggest that the Danish inspection system is effective. Denmark is starting to use the database more strategically to improve its inspections efforts. From 2020, it plans to target guidance to industries where inspection data point to a need for special efforts to bring down the number of violations. Making fuller use of the database should help Denmark gain a better understanding of non-compliance among companies and inform policy making. Denmark is introducing innovative techniques to support inspections. Legislation is implemented through the instruments of statutory orders. In the field of inspections, for example, there is an Order on reporting for environmental inspection and environmental permits, and the Order on charges for approval and inspection Environmental inspections of establishments which pose a risk is covered by the Order on risk. Environmental approvals for activities and livestock farms and environmental inspection involving certain activities and livestock farms are covered by charges. The Order on charges provides additional details as to when charges apply to an activity or livestock farm.

The Act on Compensation for Environmental Damages

The Environmental Damage Act, last amended in 2017, is the main legislation transposing the Environmental Liability Directive. It applies the polluter-pays principle by establishing that the responsible party must bear the costs associated with preventing or remedying ecological damage. The Act regulates compensation for damages done against the environment, primarily in relation to air, water, soil and the underground. Generally, no compensation may be granted for a non-economical loss unless special authorisation is provided by an Act. By virtue of Section 2, no. 1 of the Act, compensation must be given for personal damages, including physical damages and loss of a

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provider. According to Section 2, no. 2 of the Act, compensation must be given for damage on property caused by a pollution of the environment. Section 2, no. 3 of the Act prescribes that compensation must be given for economic losses which exceed the character of what is expected on the certain area. If the person injured had expenses due to prevention or avoidance of the pollution, these may be claimed according to section 2, no. 4 of the Act. The degree of liability needed to cause obligation to pay compensation differs from the ordinary liability. Any person who, with a commercial or public purpose, manages an activity, or uses a plant from which the pollution derives, is responsible for the pollution. Therefore, a strict liability exists in the area of environmental pollution. Section 196 of the Danish Penal Code makes it a crime to pollute air, water, soil or the underground to such an extent that the pollution causes significant damage or immediate danger of damage to the environment. It is also a crime to store or remove waste or similar substances where it causes significant damage or immediate danger of damage to the environment. Violations of environmental law of a systematic or organised nature are also considered crimes. However, criminal liability is reserved for the most serious breaches of environmental law. In less serious cases, Denmark applies the polluter-pays principle, requiring the polluter to bear the cost of remedying the environmental damage. Denmark transposed the EU Environmental Liability Directive in 2008 and has published a comprehensive guidance document on its application. It has not yet experienced any cases of environmental damage to which the directive applied. For the period 2007-2013, however Denmark did not report any instance of environmental damage or imminent threat that was handled under the Environmental Liability Directive, suggesting that the Danish authorities apply a high bar before the Directive is considered applicable and that alternative instruments, which were in force prior to the directive, have been considered sufficient in the concrete cases.

Voluntary agreements

Governments sometimes use voluntary agreements with business as an alternative or supplement to other policy instruments (e.g. direct environmental regulation, taxes, tradable emission permits), as they are thought by some to be more flexible, efficient or consensus-based. However, if voluntary agreements are not backed by a credible threat of more restrictive action should targets not be met, they risk adding little value while incurring administrative costs for both authorities and companies (OECD, 2003). Denmark's use of agreements and formalised partnerships between the public and private sectors on the environment reflects a tradition of civil-society involvement in policy making. Such arrangements also help create consensus and continuity on environmental policies, a preference reflected in the system of informal cross-party political agreements as well. When voluntary agreements include quantitative targets, they are backed by explicit threats of regulatory action.

Objectives, policies and institutions for waste disposal and management

Denmark has an extensive legal framework to address the environmentally sound waste management. It consists of a general framework law complemented by regulations for specific waste streams, treatment methods and specific policy aspects of waste management (data system, deposit programmes). During the period 2005-2018, Denmark defined its main policies and objectives related to waste management in a series of plans and strategies.

Institutional framework

At the national level, responsibility for waste management policy is shared by the Ministry of Environment and Food (MEF) for overall policy objectives (environmental aspects, recycling promotion, etc.) and the Ministry of Climate, Energy and Utilities (MCEU) for economic regulation of the sector and delivery of waste management services. The transition to a circular economy is the primary responsibility of MEF, which co-ordinates inter-ministerial processes involving other ministries (Ministry of Industry, Business and Financial Affairs (MIBFA), MCEU, Ministry of Transport and Building, and Ministry of Higher Education and Science). This includes co-ordination of the circular economy strategy. MEF also co-ordinated an inter-ministerial task force on increased resource efficiency, which carried out studies to identify barriers to business uptake of resource efficiency policies. Activities are being conducted to create communication tools and guidance on the definition of waste and end-of-waste criteria, waste import and export rules, and interpretation of

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VAT regulations for used products. At the local level, the 98 municipalities are the main entities responsible for waste management. The five regional councils were in charge of orphan contaminated sites, but in March 2019 the government decided that this and other regional responsibilities would be transferred to the national level. Municipalities benefit from a large degree of autonomy in waste management planning and develop 12-year waste management plans at least every 6 years, in addition to infrastructure development, permitting and monitoring of waste management facilities (except the largest ones, which are controlled at the national level). Inter-municipal co-operation is also common. In many cases, municipalities own or co-own waste treatment facilities. Eighty-two municipalities are owners or co-owners of waste incineration plants. Municipal responsibilities are evolving. Since January 2010, they are no longer responsible for managing recyclable waste from businesses, including commercial, industrial and C&D waste. Thus they can no longer collect or treat this waste, with some exceptions, for instance where waste is collected from buildings with both households and businesses. In addition, 23 municipal waste facilities hold permits to continue treating waste from businesses. As municipalities are in charge of waste classification, they are largely free to direct high shares of total waste to the treatment facilities of their choice (e.g. the incinerator they own). What one municipality considers waste may not be classified as such in a neighbouring municipality. Waste classified as recyclable in one municipality is suitable for incineration in another. There have been complaints by private companies and industry sectors about waste classification differing among municipalities, adding to operators' administrative burden. This lack of harmonisation makes the playing field uneven for enterprises operating across municipal borders.

Waste Plan

The third national Danish Waste Plan, launched in 2003 for 2005-2008, aimed not only at reducing the environmental impact of waste but also increasing effectiveness in the waste sector. In terms of waste prevention, the objective was not to decrease overall waste generation but rather to decouple its increase from economic growth. The plan included targets to increase recycling to 65% and incineration with energy recovery to 26% while reducing landfilling to 9%. It also included EU requirements and targets for certain waste streams (packaging, WEEE, ELV) (Copenhagen Resource Institute, 2013). The fourth national Danish Waste Plan (2009-2012) was developed in two parts: a strategic part linking waste management with the objectives of climate, resource and environmental protection policy, followed in 2010 by a second part focusing on prevention, particularly as regards food waste. The main targets from the previous plan were unchanged except the one on landfilling, which was lowered to 6% by 2012.

Strategy on waste management and resources

The current strategy on waste management and resources, launched in 2013 as Denmark without Waste: Recycle More, Incinerate Less (Government of Denmark, 2013), represents a paradigm change for a country that relies heavily on incineration with energy recovery to divert waste, especially household waste, from landfill. The strategic goals are reflected in the latest NWPM, Denmark without waste: Resource Plan for Waste Management 2013-2018, launched in 2014. The strategy and plan establish one main quantitative target: to collect 50% of seven household waste fractions (biowaste, paper, cardboard, glass, wood, plastic and metal) for recycling by 2022 (by contrast, 75% of household waste was incinerated in 2011). This target reflects the EU Waste Framework Directive target of separately collecting 50% of the dry fractions of municipal waste (paper, cardboard, plastic and metal), although the EU targets have a different basis for assessment. In addition, the strategy includes indicative targets to measure its effects on specific sectors. For instance, recycling of organic waste from the service sector (restaurants, food shops) is expected to reach 60% by 2022. Apart from the household waste target, most legally binding targets for waste management derive from EU targets.

Waste prevention strategy

A Waste Prevention Strategy, Denmark without Waste II (Government of Denmark, 2015), was launched in 2015 for 2015-2027. It identifies two crosscutting topics (supporting resource efficiency among businesses and green consumption) and five action areas (food waste, construction, textile,

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electrical and electronic equipment, and packaging). The strategy has seven qualitative targets combined with nine quantitative indicators to monitor progress on all topics and action areas, such as the number of businesses with a certified environmental management system, the number of eco-labelled products, and waste generation in specific industry sectors and in households. A six-year revision of the strategy is envisaged.

Circular economy strategy

A circular economy strategy (MEF and MIBFA, 2018) was adopted in September 2018. It does not include additional policy targets, but instead recognises the role of private companies as a driving force for the transition to a circular economy, envisaging voluntary commitment by the private sector to increase resource productivity by 40% between 2014 and 2030 and increase recycling to 80% of total waste (excluding mineral waste) generated. Other new requirements relevant for Denmark include separate collection of biowaste by 2023 and establishment of extended producer responsibility for packaging by 2025.

Other national strategies are of relevance for Denmark's waste, materials management and transition to a circular economy.

The National Strategy On The Sharing Economy (Government of Denmark, 2017) aims to maximise use of assets such as cars and buildings, ultimately leading to less consumption. A utilities strategy, Supply for the Future, which is under discussion, is expected to significantly modify the organisation of waste management services. It proposes increased competition in the incineration sector by letting business freely choose where to send combustible waste and making it compulsory for municipalities to organise public tenders for household waste treatment for recycling and incineration. It also suggests directing all recyclable waste treatment to the private sector; the role is currently divided between municipalities and the private sector.

Environmental Protection Act on waste management

The Environmental Protection Act (Consolidation Act No. 966 of 23 June 2017) provides the general framework law and establishes the main objectives of environmental protection, including for waste. It is accompanied by a framework regulation, the Statutory Order on Waste (Affaldsbekendtgørelsen), the main legal instrument governing waste management. Regulations cover various waste streams (batteries, ELVs, tyres, WEEE, residual waste, bio-ash, soil moving), waste treatment types (incineration, landfill) and aspects of waste management policies (data, register, impact assessment, environmental supervision, deposit systems). Regarding taxation, a 2011 law establishes taxes on waste and raw materials while a regulation establishes a packaging tax.

Public participation

Denmark has mainly regulated public participation in decision making through the Danish Environmental Assessment Act and some sectoral legislation. The National Planning Law also contains provisions governing the involvement of the public in local planning. These provisions require stakeholder consultation; publication of plans with time to consult in advance; minimum consultation periods; consideration of input; and publication of comments and revisions. The 2017 Eurobarometer shows there is a strong agreement in Denmark (88% of respondents) that an individual can play a role in protecting the environment. This percentage is largely unchanged compared to 2014. Denmark provides excellent public participation and generally an effective access to justice in environmental matters. The public may, however, face problems obtaining legal standing when an authority refuses to intervene in case of an unlawful.The INSPIRE Directive is a pioneering instrument for electronic data-sharing between public authorities who can vary in their data-sharing policies, e.g. on whether access to data is for free. The INSPIRE Directive sets up a geoportal which indicates the level of shared spatial data in each Member State –i.e. data related to specific locations, such as air quality monitoring data. Amongst other benefits it facilitates the public authorities' reporting obligations. For each Member State, the accessibility of environmental data (based on what the INSPIRE Directive envisages) as well as data-sharing policies ('open data') have been systematically reviewed. Denmark's performance on the implementation of the INSPIRE Directive as

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enabling framework to actively disseminate environmental information to the public leaves room for improvement.

4.2. Environmental policies in Portugal

4.2.1. Recent amendments in local legislations in the field of green practices for maintenance of sustainable ecosystems and improvement of the soil, air and water

From 2013 to 2015 was a particularly eventful period for the policy landscape in Portugal. Several national plans were revised, placing strong emphasis on efficiency and meeting EU targets in the most cost-effective way, and new types of policies were introduced (e.g. Green Taxation Reform). Also, the Partnership Agreement for Portugal 2014-2020 was put in place, with many operational programs already funding innovation-related projects. The year 2015 represents the start of a new cycle for the Portuguese economy, after an adjustment period that ran from 2011 to 2014, which required external assistance and a rigid financial policy. The economic deceleration of previous years is still felt in important sectors of the economy – construction and transport – and continues to influence the country's performance in terms of resource efficiency and climate change. Still, there are some positive signs: e.g. improvements in foreign energy dependence (from 79.8% in 2012 to 71% in 2014), environmental certifications, trends from previous EIO assessments coming to fruition, with sustainable agricultural and forestry practices (up to 6% of agricultural used soil for organic farming in 2013), a reduction in the use of phitopharmaceuticals, and sustainable water management is coming into focus, after the release of the National Water Plan (in 2015) and the future approval of the new cycle of River Basin Management Plans (in 2016) following public consultation held in the last semester of 2015. In addition, the GGC is a national strategy favouring the transition to a greener (and more circular) development model (see Section 1). The GGC monitoring framework is already established and delivering the assessment of the country's performance. However, the rapid evolution of environmental policies, towards a more circular and lowcarbon economy, called for adjustments in the GGC's framework of measures as well as stakeholder interaction. The First National Adaptation Strategy (ENAAC) was adopted in 2010 (2010-2015) and revised in 2015 (ENAAC 2020 for 2015-2020). There is a significant shift towards the development of Local Adaptation Strategies, with the project ClimAdaPT. Local having led to 27 local adaptation strategies. A National Adaptation Action Plan (NAP) based on the selection of actions foreseen in the biannual activity planning from some sectors and transversal areas is currently under public consultation. Nine priority sectors have been identified: agriculture, biodiversity, economy, energy, forests, health, safety of people and assets, transport and communications, and coastal areas/sea. The years 2016 and 2017 represent a breakthrough in the Portuguese circular economy landscape. The Portuguese Government launched several instruments to support the transition to the circular economy, namely open calls supported by the Fundo Ambiental and the Plano de Ação para a Economia Circular em Portugal 2017-2020 (Action Plan for the Circular Economy in Portugal 2014-2020). These, along with a comprehensive communication strategy, have helped spur a wide interest for the circular economy in companies, public administration and civil society. In 2017, Portugal obtained a EcoI Index of 104, in relation to the EU average (=100), continuing its upward trend from previous years (96 in 2016, 92 in 2015 and 2014, 81 in 2013, 88 in 2012) and is currently ranked 10th among EU Member-states. This is also the first year that Portugal is above the EU-28 average score, i.e. has a EcoI Index above 100.

Environmental "green" strategies

The National Environmental Education Strategy for 2017-2020 (ENEA 2020) was adopted in 2017 and aims to establish a collaborative, strategic and cohesive commitment to environmental literacy in Portugal. It fosters an inclusive and visionary citizenship that leads to a change in civilisational paradigm, translated into sustainable models of conduct in all dimensions of human activity. Actions envisaged in ENEA 2020 contribute for active citizenship in the field of sustainable development and for the construction of a just, inclusive, low-carbon, rational and efficient on the use

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of resources, which combines the equity between generations, the quality of life of citizens and the economic development. Portugal has a thematic agenda for Research and Innovation in Circular Economy. This agenda is another strategy for a transition to the circular economy that enhances sustainability, resilience, inclusion and advantage of society. The agenda is a multi-dimensional research guide for research and the search and response prospects for the country in a medium- and long-term attempt (2030): i) Design and development of new products, processes and services; ii) Sustainable management of resource cycles; iii) Governance and territory; iv) New business models, behavior and consumption

In the interests of promoting sustainable urban development and in line with mainstream European strategies and programmes, Portugal approved the Sustainable Cities 2020 Strategy in 2015. This guiding document provides municipalities, inter-municipal bodies and other urban stakeholders with a roadmap on urban sustainability for the next EU funding cycle, which runs up to 2020. The document outlines a set of non-binding strategic guidelines to be adopted by Portuguese cities and towns. These lay the foundations on which Sustainable Cities 2020 can be put into practice, through the launch of a range of tools promoting its implementation. This strategy is designed to reinforce the strategic dimension of the role of cities in various areas, namely: urban regeneration and restoration, the urban environment, low carbon, climate change, and risks. It is based on the paradigm of sustainable urban development. This requires the involvement and commitment of various players, so that the focus of interventions is not limited to the physical dimension of the urban area, but rather, seeks to achieve aims such as economic development, social inclusion, education, participation and environmental protection.

The Fundo Ambiental

The Environmental Fund, created in 2016, continues to support circular economy projects. It began operating in 2017 and in that year alone over EUR 41 million were invested in projects related to climate change, circular economy, nature conservation and environmental awareness. The EU has provided guidance on the further deployment of green and blue infrastructure in Portugal and a country page on the Biodiversity Information System for Europe (BISE). This information will also contribute to the final evaluation of the EU Biodiversity Strategy to 2020.

Climate

The National Sustainable Development Strategy, ENDS 2015 (APA, 2008), was prepared taking into account the guidance principles of the European Strategy for Sustainable Development (EC, 2001) and aims to respond to its main objectives, namely at the level of climate change, renewable energies, transportation, sustainable production and consumption, and natural resource management and conservation. The main priority of the national strategy is integrated waste management, particularly of domestic, industrial and hospital waste, aiming at their reduction, reuse, recycling and recovery, as well as their safe disposal; it establishes goals related to waste prevention and extends a material recovery approach to fulfil recycling targets (EEA, 2011). The National Climate Change Programme 2006 (PNAC) includes a set of policies and measures aiming to control and reduce emissions of GHG, so that Portugal meets the Kyoto Protocol commitments and the EU Sharing Agreement, by which Portugal was forced to limit, between 2008 and 2012, the increase in GHG emissions by 27% compared to the 1990 value. This programme includes policies, measures and instruments as part of a reference scenario and a set of additional measures for different sectors, with impact on the national balance of GHG emissions (EEA, 2011).

Eco-innovations

In the main eco-innovation areas, there are five policy plans implemented in 2013 which deserve attention.

- The National Urban Waste Strategy Plan - PERSU 2020 (MAOTE,2013b), which extensively mentions the need to support innovative technology development and application in the context of waste management and resource efficiency, ultimately improving the country’s economic performance in the medium to long term.

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- In the agricultural sector, the National Rural Development Program 2020 (MAM, 2013), with a specific axis directed at innovation support and development for promoting sustainable resource use and solving resource efficiency issues, particularly in what concerns water management. For example, one of the policy instruments considered is fiscal rewards to farmers that include water efficiency measures in their business developments (PUBLICO, 2014).
- The Strategic Plan for Tourism 2013-2015 (ME, 2013) also focuses on innovation as key in competitiveness of the sector, coupled with a rational use of natural resources and promotion of environmental sustainability.
- The NAP for Energy Efficiency and Renewable Energies (DRE, 2013) which encompasses several sectors, with special emphasis on the public sector, formalises several programs directed at promoting energy efficiency and establishes targets to be achieved. In this context, it expected further support to innovative technologies and services to achieve those particular targets.

Resources

The National Energy Strategy, ENE 2020 (MEID, 2010), established by the Cabinet Resolution 29/2010 of 15 April 2010, as an update of the previous strategy (2005). Two of the core objectives are the increase of renewable energy sources (RES) and the improvement of energy efficiency, to enable reduction of imports and increase security of supply, as well as reduce the environmental impact and CO_2 emissions. The market deployment of RES and the development of R&D and industrial clusters for new energy technologies became a major policy objective, to contribute to economic growth and job creation (EEA, 2011).

Water

Water is another area that is currently undergoing particular attention, given the publication of the National Water Plan, the new cycle of River Basin Management Plans and given the evident challenges brought by climate change. As reported in the previous EIO report, the country has been through increasingly severe drought periods and extreme floods (IPMA, 2016), which represents a risk for several sectors – industry, agriculture, energy production and domestic consumers. Water efficiency, quality and risk are the main topics being addressed, with particular emphasis on the deployment of innovative water efficiency (certification, control), monitoring and reporting systems, integrated with regional Planning.

Soil

In 2014, the National Action Programme to Combat Desertification (PANCD) was updated (building on a previous version dating back to 1999). PANCD is fully aligned with the vision, the mission, and the strategic and operational objectives and goals of the 10-Year Strategy of the UN Convention to Combat Desertification. PANCD is a cornerstone strategy for the protection and recovery of affected soil in Portugal. It defines the institutional framework responsible for ensuring implementation and establishing a desertification monitoring system to assess its effects and trends. It defines a strategic vision, setting four strategic objectives: to promote the improvement of the living conditions of people living in areas vulnerable to desertification; to promote the sustainable management of ecosystems in areas vulnerable to desertification and the recovery of affected areas; to generate global benefits and potential synergies with the processes of climate change and biodiversity in sensitive areas; to promote and mobilise resources to implement the UNCCD and PANCD and associated specific objectives, lines of action and indicators. In the last few years, Portugal has made great efforts to align with the green growth and the circular economy paradigms. Due to its relatively weak economic growth within the European Union, Portuguese authorities have looked for new ways to improve its competitiveness and economic standing. The environmental authorities have been particularly diligent in this regard, looking for ways to boost the economy through resource efficiency and eco-innovation. More recently, with a strong push towards the circular economy, the Portuguese Government and other regional authorities have committed to tackle environmental and economic problems with a coherent strategy. These efforts from public authorities are well represented in the

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Green Growth Coalition and the recent Plano de Ação para a Economia Circular initiatives. However, it is also important to stress that past experiences show that promising public-sector initiatives, such as the Ecopol project, which ran from 2011 to 2014 (ANI, 2015), have not translated to public policy as successfully as expected and remains valid in 2016 and 2017.

Past and current environmental trends

Until 2013

Regarding the **waste** sector, in 2013 the total production of municipal waste in mainland Portugal (4 362 million tons) decreased by about 4% compared to the previous year, from 454 kg per capita in 2012 to 438 kg per capita in 2013. This was below the EU-28 average for 2012 of 492 kg per capita per year. The percentage of municipal waste sent to landfill remains high (43%). Of the remaining municipal waste, 22% goes to energy recovery, 17% to mechanical and biological treatment, 9% to material recovery, 7% to mechanical treatment and 2% to organic recovery. In mainland Portugal, the total area under organic agriculture increased from 0,2% to 6,1% between 1994 and 2012, reaching a share greater than the 2011 EU-27 average of 5,5%. The protected areas of Portugal, classified under the National Network of Protected Areas and Natura 2000 represented 22% of mainland Portugal in 2013. In 2013, air quality recorded a significant number of days rated "Good" and "Very Good", and a reduction in the number of days rated "Poor" and "Bad". However, the number of episodes of tropospheric ozone pollution and of fine particles pollution were higher than the long-term target established.

Figure 23. Environmental statistics of Portugal 2010-2018; State of Environment Report Portugal, 2019

After 2013

Portugal is among the most vulnerable European countries when it comes to the **impacts of climate change**. To address this issue, the government has been working towards the implementation of a post-2012 climate policy, focusing its priorities on the operational parts of both the National Strategy for Climate Change Adaptation and the National Programme for Climate Change. The government has also focused on monitoring the reconfiguration of the European Union Emissions Trading Scheme, on preparing the country for post-Kyoto challenges, and on reviewing the Portuguese Carbon Fund. Portugal faces some challenges in implementing green infrastructure: (i) reconciling policies targeting business and policies benefiting the environment more satisfactorily, (ii) improving information to national protected areas managers, populations, economic operators and other stakeholders about the benefits of green infrastructure, and (iii) promoting the socioeconomic growth benefits of green infrastructure, particularly in the urban and rural contexts. Reporting to the Convention on Biological Diversity (CBD) on resource mobilisation from Portugal is still pending for

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2015. Reporting on financial flows to the CBD is important for the position of the EU and its members in the CBD. It also helps support good practice in other countries. In mainland Portugal, 2018 was classified as normal, both in relation to air temperature and to the amount of rainfall. Considering the “Air and Noise” domain, in what concerns air quality, “Good” was the predominant rating of the air quality index (IQAr) in recent years, a trend that continued in 2018. Another positive aspect was the significant reduction in the number of days rated “Moderate”, “Poor” and “Very poor” observed in recent years and maintained in 2018. With respect to inhalable particle pollution, there is a clearly decreasing trend in the average annual concentration of PM10 between 2001 (45.3 $\mu g/m^3$) and 2017 (16 $\mu g/ m^3$), and all annual values observed in the last 16 years are below the threshold imposed by law (40 $\mu g/m^3$). In the case of air pollution by nitrogen dioxide (NO_2), the annual limit value of NO_2 concentration (40 $\mu g/m^3$) was exceeded in 2017 in the agglomerations of Porto Litoral, Entre Douro e Minho and in the Northern Lisbon Metropolitan Area, with 54 $\mu g/m^3$, 55 $\mu g/m^3$ and 60 $\mu g/m^3$, respectively. Regarding the precursors of tropospheric ozone (nitrogen oxides and non-methane volatile organic compounds), the value of the formation potential of tropospheric ozone, which gives us the aggregate emissions of these compounds, decreased approximately 38% since 1990.

Water policies

With regard to **water resources**, a new planning cycle is being prepared, which includes the revision of the National Water Plan, further implementation of the National Program for the Efficient Use of Water , and the review of the River Basin Management Plans. The new strategy for the urban water sector for the period 2014-2020, called "PENSAAR 2020 - A new strategy for the water-supply and wastewater treatment sectors (2014-2020)", will soon be published. The main objective of the PENSAAR 2020 (Governo de Portugal, 2015a), the national plan for water distribution and sanitation, is to promote the optimisation and efficiency of water distribution and sanitation systems, and thus refrains from large investments in expanding capacity, as was done in the past. Several actions are proposed to increase the lifetime of these infrastructures, promote their use at optimal capacity and control operational expenditure. These will help reduce overall costs of the system, which can then be translated into a reduction in tariffs for families and companies. There are also measures proposed for decreasing water losses in distribution, mostly through the requalification of the distribution network, and to increase the reuse of treatment sludge and residual water, and for the production of electricity. Portugal is the only EU Member State to have identified 'less sensitive' areas, that is, areas whose intrinsic features mean that they are, in principle, not adversely affected by wastewater discharges. Current investment in collecting systems and treatment plants to ensure compliance is estimated at an average EUR 49.5 million annually (EUR 5 per inhabitant.) Such investment takes no account of the funds needed to renew and extend existing infrastructure, specifically the collecting systems. According to this latest report, the final projects were completed by 2019, a long time after the final 2005 deadline which the Directive set for Portugal. In Portugal, agriculture account for about 80% of total water consumption. Although the amount of water used in farming has fallen in recent years, significant scope remains for saving water. While much depends on improving water pricing policy, there is also significant potential for water savings through innovation. Despite the progress achieved in recent years in water management, challenges remain, for instance with water governance and the need to close gaps in water investments, especially for wastewater. At the municipal level, the sector remains highly fragmented and the reorganisation of the water and wastewater services has not yet shown its full potential. A central issue in Portuguese environmental policies is the vulnerability of the country's **coastal zones**. Policies regarding this subject have begun focusing on integrated coastal zone management, uniting maritime policies with climate-change adaptation policies. In 2014 the implementation process of the Coastal Valorisation and Protection Plan for Portugal (2012-15) will continue. The National Sea Strategy 2013-2020[12] presents a new development model of ocean and coastal areas, which will allow Portugal to promote the growth and competitiveness of the maritime economy. In the “Water” domain, the quality of drinking water remains excellent (99% of safe water in the consumer’s tap in 2017). In 2018, the excellent quality of monitored bathing waters was

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maintained. Of the 608 bathing waters identified, 554 (91.1%) presented “excellent” quality, 29 (4.8%) presented “good” quality, nine (1.5%) “acceptable” quality, and only two (0.3%) showed “bad” quality. There were also 14 “unclassified” bathing waters (2.3%), because although they were monitored, they didn’t have the minimum 16 samples from the previous years, which is a classification requirement. By analysing the use of water resources in terms of submitted applications and respective permits issued, one can see that, in 2018, about 82.4% of the total issued permits relate to water abstractions and 9.5% wastewater rejection.

Biodiversity

The “Soil and Biodiversity” domain discloses the population’s interest in the conservation and sustainable use of biodiversity, which is reflected by the consistent increase in the total number of visitors in protected areas, which amounted to 420,905 in 2018 (-2% than in 2017). In Portugal, the Natura 2000 Network is composed of 107 designated areas under the Habitats Directive and 62 Special Protection Areas designated under the Birds Directive, distributed by the Mainland and Autonomous Regions. In total, this network covers about 22% of the land area and about 39 000 Km^2 of marine area. As noted in the previous EIR report, 29% of biogeographic assessments of habitats were favourable in 2013 (EU-27: 16 %). 58 % are considered unfavourable–inadequate (EU-27: 47 %), while 8 % are unfavourable–bad (EU-27: 30%). As for species, 19 % of assessments were favourable in 2013 (EU-27: 23 %), 31 % were unfavourable-inadequate (EU-27: 42 %) and 10 % were unfavourable-bad (EU-27: 18 %). As regards birds, 43 % of breeding species showed short-term increases or stable population trends (for wintering species, this figure was 57 %). Overall, the status of natural habitats and species covered by the Habitats Directive has improved in Portugal, although many are still in a poor unfavourable. Progress in following up the 'suggested actions' in this area that were set out in the 2017 EIR has been limited. Therefore, they overall remain valid for the 2019 EIR. The effort made to support more sustainable agricultural and forestry practices that contribute to the preservation of resources resulted, among other things, in the considerable increase in the agricultural area under organic farming, which rose 26% from 2010 to 2017. The Portuguese Government approved the country’s National Strategy for Nature Conservation and Biodiversity for 2030 (NSNCB) on 5 April 2018. The NSNCB Vision is: to achieve a good conservation status of the natural heritage by 2050, based on the progressive appropriation by society of the design of biodiversity, by both acknowledging its significance for the country’s development and pursuing management models that advocate a closer approach to those working on the ground in the territories. Taking into account the 2030 Sustainable Development Agenda, the Strategic Plan of the Convention on Biological Diversity and the European Union Strategy for Biodiversity, the NSNCB provides a framework for addressing the challenges Portugal will face between 2018 and 2030. The principles underpinning the previous national strategy have been reinterpreted in the light of the current challenges. There are three strategic aims: to improve the conservation status of habitats and species; to instil in society a sense of responsibility for the natural environment and biodiversity; to promote recognition of the value of the natural heritage and integrate this awareness into a number of policies, strategies and practices. The new Strategy sets out goals to be achieved by 2030, ranked by priority. Each goal is broken down into over 107 measures, each with indicators, priorities, deadlines, means of verification, tools and responsible entities. Several other strategies and plans include green infrastructure activities. For instance, the Natura 2000 Sector Plan, the National Network of Protected Areas, and the various levels of spatial plans and programmes (protected areas, coastal areas, reservoirs, municipal and regional special plans). It is worth to mention also the National Programme on Spatial Planning Policy (PNPOT), together with the National Strategies for Nature Conservation and Biodiversity and for the Oceans, designed to create a network of protected marine areas to reconcile economic activity with protection for estuarine, coastal and oceanic ecosystems. As regards funding for green areas, legislation adopted in 2008 (the Fundamental Network for Nature conservation – RFCN) established a new economic and financial framework for nature conservation and biodiversity and the Fund for Nature Conservation and Biodiversity (that in 2016 was integrated in the new Environmental Fund). There is also a Permanent Forest Fund (FFP) to finance sustainable

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forest management. The Operational Programme for Sustainability and Resource Efficiency (POSEUR) allocates funding to projects dealing with biodiversity and ecosystems. There is still scope for encouraging private funding in cooperation with NGOs.

4.2.2. Waste disposal and management policies

At the beginning of this decade, a period of reduction of municipal waste production was observed. However, since 2014, municipal waste production has been increasing, reaching 4.94 million tonnes in 2018 in mainland Portugal (+4.2% compared to 2017), which corresponds to a daily production of 1.38 kg per capita. In this year, the rate of preparation for reuse and recycling of municipal waste was 40%, maintaining the upward trend observed in the last decade. The NWMP's vision is to promote an integrated waste management based on product life cycle, focused on a circular economy to achieve a greater natural resources use efficiency. A strategic goal is to stimulate the efficient use of natural resources in the economy through a) waste prevention, b) promotion of responsible production and consumption standards, c) reduction of materials and resources extraction, as well as through d) the usage of recycled and recovered materials in product life cycles. Another important area in the scope of the NWMP is the issue of food waste. The Circular Economy package is setting the ambitious task of reducing landfill deposits to 10% by 2030. But Portugal is still struggling with high landfill rates (42% of urban waste) (APA, 2016), despite recent improvements in recovery technologies, particularly mechanical and biological treatment. Still, in spite of a closer articulation between landfill diversion and recovery options (material and energy), biodegradable waste represents 55% of this material (APA, 2015b). It is becoming apparent that systems cannot keep achieving ever-higher organic treatment efficiencies since it is economically demanding; therefore, action must also be made on preventing the creation of organic waste, at the source. In Portugal, a 2012 study reported estimated losses of 1,031 Mt of food products per year (representing 1.1% of the EU-28 total) in production, processing, distribution and consumption (APA, 2016). Recognising the importance of this issue has led the government to declare 2016 as the National Year to Combat Food Waste, integrating measures such as targets for local produce use in public canteens, sustainable menus, or mandated food donations for supermarkets with areas over 400 m^2. These open a new and interesting area, in which eco-innovations, particularly in services, are already emerging and are set to gain momentum in the coming years. Disposal of BMW in landfills increased for the second consecutive year and amounted to 46% in 2018. Regarding the recycling of specific waste streams (packaging and packaging waste, used lubricating oils, used tyres, waste electrical and electronic equipment, waste batteries and accumulators, end-of-life vehicles and construction and demolition waste), the recycling rates achieved in 2017 met the overall targets defined in the legislation, except for end-of-life vehicles, which are estimated to have been 1% below the target set for 2015 (85%). Specifically analysing the packaging waste stream, approximately 1.71 million tonnes were produced in 2017, resulting in a recycling rate of 55% and a recovery rate of 65%. By type of packaging material, the provisional data indicates decreases in the recycling rates for paper and cardboard and plastic and glass, when compared to 2016. For metal packaging, the recycling rate has increased slightly. Below the recommended targets are the recycling of glass and metal packaging. The production of hazardous waste in Portugal peaked in 2017, registering around 918 thousand tonnes, +10% in relation to 2016. Most of the hazardous waste produced in Portugal originated from waste collection, treatment and disposal activities (36.9%). Of the hazardous waste treated in 2017, 61% was disposed of and 39% was sent for recovery. Waste streams from Batteries and Accumulators and Used Food Oils have no established recycling goal. However, there is a target for the collection of waste streams from Batteries and Accumulators, defined in the Community directive and national legislation, whose value is 45%, to be fulfilled until 31 December 2015, remaining unchanged until the present. The total revenue of the waste management entities, resulting from the compliance fee - ecovalor - assumed by the producers for the environmental impacts associated with their products, was around EUR 101 million in 2017 (provisional data), which represented an increase of 21% compared to the previous year, due to the entry into force of a new generation of permits for systems of specific waste streams, which assign increased obligations to the Managing Entities in order to

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increase management transparency, as well as reduce the recovery cost of various materials. The total production of municipal waste in mainland Portugal was, in 2018, of approximately 4.94 million tonnes (+4.2% compared to 2017), corresponding to an annual capitation of 505 kg/(inhab.year), i.e., a daily MW production of 1.38 kg per inhabitant. These values confirm the increasing trend in waste generation observed since 2014. This increase may be related to an improvement of the economic situation in Portugal, which seems to indicate that the objective of dissociating waste production from economic growth is not being achieved. Regarding collection, there was no significant difference when compared to 2017, the prevalence of bulk collection for the vast majority of collected waste is maintained. Increasing the quality and quantity of separately collected recyclable waste is a goal of the waste policy highlighted in PERSU 2020 by setting a specific target for selective collection recoveries, albeit focusing only on some materials (paper, cardboard, glass, metal and plastic). Although a significant effort has been made in recent years to increase the number of separate collection infrastructures, namely ecopoints and ecocenters, it evident that this did not have a proportional effect on separately collected quantities. In 2018, there were 23 Municipal Waste Management Systems (SGRU) covering the entire mainland territory. Each one of these systems has infrastructures to ensure an appropriate final destination for the municipal waste produced in their respective area. In relation to the production per capita and per SGRU, there is, as it should be, a greater production in the Management Systems where more population is concentrated. However, in terms of production per capita, these differences are harmonised, with higher values in the Alentejo and Algarve Management Systems, a common phenomenon explained by the seasonality effect. In recent years, there was an increase in the value of the indicator, which is certainly a result of the implementation of the strategies provided for in PERSU II and PERSU 2020. Nevertheless, a major effort will be required to achieve the proposed target for 2020 (50%). The short period of time given to reach the target of preparing for reuse and recycling for municipal waste, will involve considerable effort. According to PERSU 2020 this will require a significant increase in the efficiency of both separate collection schemes, and sorting/recovery facilities (mainly mechanical treatment and mechanical biological treatment), as well as the recovery of the organic fraction in dedicated units or MBT. The diversion of BMW from landfill is also a pressing objective since organic waste is the one that presents greater emission potential, consubstantiating a fraction with increased environmental impact. Regarding MW direct destinations, it can also be seen that direct landfill deposition increased from 32% in 2017 to 33.4% in 2018, and that the shipment of waste for incineration remains stable as a destination for 20% of the MW generated. For a country like Portugal, traditionally dependent on external fossil energy resources, it is essential to improve competitiveness through a more rational and efficient use of energy, while ensuring climate sustainability. So, in 2013, the new National Energy Efficiency Action Plan and the National Renewable Energies Action Plan were approved for the period 2013-2020. These two plans established an overall goal of reducing primary energy consumption by 25% by 2020, and a specific goal for the public administration to reduce primary energy consumption by 30% by the same date. As regards forests, the 2017 EIR stressed that Portugal faces the following challenges: private ownership of most woodland, intensive farming, the spread of the pine wood nematode, and the high risk of forest fires. Portugal is severely affected by forest fires, owing to more extreme weather conditions and changes in land use. Since 2000, such fires have affected over 29 000 km^2 (nearly 32% of the country’s total area as some areas were affected several times). While the total number of wildfires has fallen over the last 15 years, Portugal still suffers from episodes of catastrophic 'megafires' which burn very large areas and are almost impossible to extinguish unless weather conditions change. A case in point was 2017, with the worst fire season in Portuguese history in terms of the area burned (about 5 300 km^2), damage to property, and, above all, loss of life. Extreme weather events such as heatwaves, severe droughts and strong winds are expected to occur more frequently in the context of climate change. Policy and management options for reducing forest fires must address their root causes. Changes in land use and forest management favoured the accumulation of large amounts of potential fuel and increased the fireproneness of forests and therefore also fire risk and magnitude. Examples are abandonment of pastoralism and

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agriculture, neglect of traditional forest management leading to compact forest and shrub masses or significant expansion of fire prone eucalyptus or pine plantations. Apart from investments into restoring the forests affected, more efforts are hence needed to prevent the outbreak of wildfires and to minimise the conditions for their spread and progression. This should include policies to strengthen forest resilience and avoid highly fire-prone forests, particularly if left unmanaged. Portugal is taking measures in this regard. For instance, the National Forest Strategy has been recently updated.

4.3. Environmental policies in Estonia

Estonia ranks 14th in the worldwide Environmental Democracy Index. The country has come a long way down the road of European integration, making its legal framework consistent with EU environmental acquis. It achieved great progress in environmental democracy in the process. The country is consolidating legislation to eliminate inconsistencies and cut red tape for businesses. Estonia's environmental governance is centralised, except for local environmental services.

4.3.1. Environmental information

Estonia has a mixed governance structure. There are two important environmental portals, one run by the Environmental Agency and one by the Ministry of Environment. They have a similar structure and overlap in the areas of water, air and emissions. They are generally well linked. The portals include some monitoring data in tables and graphs of indicators. For air, the Estonian Environmental Research Centre runs a separate portal. Information on chemicals was not available on any of the environmental portals, only monitoring data related to water. Information on chemicals was, however, found on the Health Board's chemical safety portal. The main environmental portals focus on providing information on national plans, national legislation and high level indicators in a number of domains.

Public participation

The government is actively involved in environmental education and awareness raising .The general part of Estonia's Environmental Code Act and its Administrative Procedure Act include general obligations for public participation and for open proceedings in decision making. These are complemented by a variety of sector-specific environmental laws in the areas of air, nature, water and waste. In practice, the Estonian Ministry of Environment website includes a clearly visible section on public consultation. Moreover, there are a number of government web portals that promote public participation in government work. A good example of proactively engaging with the public is the annual 'partnering event', where the Ministry of Environment introduces its annual workplan and priorities and leads a discussion of current hot topics. Participation in this event increases each year (120 participants in 2018). The public has clear right of access to environmental information and ample opportunities to take part in policy making, environmental assessment, permitting and spatial planning.14th in the worldwide Environmental Democracy Index. Estonia's citizen engagement activities have been identified as good practices in the context of the Commission's Better Regulation Toolbox.

Green taxation and environmentally harmful subsidies

Estonia's revenue from environment-related taxes remains among the highest in the EU. Environmental taxes accounted for 2.88 % of GDP in 2017 (EU-28 average 2.4 %) and energy taxes for 2.54 % of GDP (EU average 1.84 %). In the same year, environmental tax revenues were 8.73 % of total revenues from taxes and social security contributions (higher than the EU-28 average of 5.97 %). Estonia's tax structure shows that the proportion of revenues from labour tax in total tax revenues is in line with the EU average, at 49.9 % in 2016, while the implicit tax burden on labour was 34.1 %. Consumption taxes remained relatively high (42.5 %, 4th in EU-28), showing that there is limited potential to shift taxes from labour to consumption, particularly to environmental taxes. One of the positive environmental fiscal measures introduced in Estonia is the mineral resource extraction charge imposed on various state-owned construction rocks, energy minerals and minerals used in agriculture, based on the quantity of the extracted resource. Another good example is the hunting and fishing fee

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system, from which 77 % of revenues are earmarked for conservation purposes. Reasonable progress has been made on reducing the ‘diesel differential’ (difference in the price of diesel versus petrol) since 2005. In 2016, there was still an 8 % gap between petrol and diesel tax rates, making Estonia the 4th best performing country in the EU. Excise tax rates levied on petrol and diesel in 2016 remained similar to those in 2015 in national currency (EUR 0.46 per litre for petrol and EUR 0.44 for diesel). A planned increase in the diesel tax rate for 2018 was not implemented due to concerns about rising fuel tourism, as rates in Estonia are appreciably higher than those in its neighbouring countries other than Sweden and Finland. The Environmental Inspectorate has introduced riskbased planning of its activities **(Figure 24)**. This has improved detection of offences, although inspectors largely react to complaints and incidents. Monetary penalties for environmental violations have increased substantially over the last decade, but it is not clear whether they are an effective deterrent. Sanctions are not always proportionate to the seriousness of non-compliance. Average fine for environmental violations is EUR 248.

Figure 24. Inspections are better targeted; Source: Evironmental performance review, Estonia highlights 2017

Environmental funding and investments

European Structural and Investment Fund (ESIF) rules oblige Member States to include environment and climate objectives in their funding strategies and programmes for economic, social and territorial cohesion, rural development and maritime policy. Achieving sustainability requires the mobilisation of public and private financing sources. Using the European Structural and Investment Funds (ESIF) is essential to achieving environmental goals and integrating them into other policy areas. Other instruments such as Horizon 2020, the LIFE programme and the EFSI may also support implementation and spread good practices.

European Structural and Investment Funds 2014-2020

Through three national and regional programmes, Estonia has been allocated EUR 4.46 billion from ESIF funds for 2014-2020. This means that with its national contribution of EUR 1.54 billion, Estonia has a total budget of EUR 6 billion to invest in areas such as the lowcarbon economy, sustainable transport, environmental protection and adaptation to climate change. Estonia’s annual total public environmental expenditure as a percentage of GDP is estimated at around 1.67 %.

Cohesion policy

Estonia has been allocated over EUR 4.4 billion from EU sources in total cohesion policy funding for 2014-2020, including EUR 1.07 billion from the Cohesion Fund, EUR 443 million from the European Social Fund and EUR 2.46 billion from the ERDF. Directly allocated investments in environmental infrastructure added up to EUR 800 million in 2007-2013. Estonia has allocated the highest EU amount of Cohesion Policy funds to direct environmental investments, with EUR 956 total per capita since 2000. EU funds are a key asset for protecting the environment in Estonia. One of the Commission’s investment priorities for Estonia in 2014-2020 is to use natural resources more

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efficiently and create a less energy- and carbon-intensive economy. Boosting investment in these areas will help the country transition to a circular economy. Innovation and the low-carbon economy are key areas to consider when estimating environmental spending. The ERDF has allocated EUR 57 million to Estonia’s lowcarbon economy. The ERDF supports projects such as the Narva Water and Sewage Treatment System Construction, including with investment in the treatment and distribution of drinking water and collection of wastewater for all residents of Narva. Significant environmental benefits stem from the elimination of groundwater and subsoil contamination, made possible by the reconstruction of waste-water collectors and elimination of leakages.

European Maritime and Fisheries Fund

Estonia has allocated around EUR 129 million in cofinancing for the fisheries and maritime sector, with a EU contribution of EUR 101 million. This has helped finance projects that benefit the environment in the sustainable fisheries and sustainable aquaculture areas of Estonia’s operational programme. The proportion of funding for environmental projects is around 20 %, representing more than EUR 32 million. The energy efficiency of the fishing fleet will be improved with the replacement and modernisation of 140 engines. Other actions will also help reduce GHG emissions and conserve or rehabilitate 9 000 hectares of terrain.

The Connecting Europe Facility (CEF)

The CEF is a key EU funding instrument developed specifically to direct investment into European transport, energy and digital infrastructures. It aims to address identified missing links and bottlenecks and promote sustainability. By the end of 2017, Estonia had signed project agreements amounting to EUR 208 million under the CEF. EUR 15 million will go to the deployment of hydrogen refueling stations, tackling the demand for hydrogen vehicles.

Horizon 2020

Estonia has benefited from Horizon 2020 funding since the programme started in 2014. As of January 2019, 140 participants have been granted a maximum amount of EUR 41.6 million for projects from the Societal Challenges work programmes dealing with environmental issues. In addition to the abovementioned work programmes, climate and biodiversity expenditure is present across the entire Horizon 2020. Several successful projects are taking place in Estonia. The LAkHsMI project is developing new monitoring and imaging technology for water that could be used for the production of renewable energy and to improve the conservation of autochthonous species. The LeanShips project is trying to create greener ships, which would cut fuel use and CO2 emissions by 25 % .

Climate change

The Estonian low-carbon strategy, “General Principles of Estonian Climate Policy until 2050 (Climate Policy 2050)” was adopted by the Parliament in April 2017. The strategy presents a long-term vision of Estonia’s climate policy and actions to be implemented by 2050. According to the guidelines, Estonia will aim to create a competitive low-carbon economy and reduce GHG emissions in the energy, transportation, industry, agriculture, forestry and waste management sectors by at least 80 % by 2050, compared to 1990 levels. This would mean a reduction of Estonia’s current GHG emissions to the level of 8 million tonnes of CO_2eq by 2050 (MoE, 2016). Estonia also has interim goals for 2030 (reduction by 70 % compared to 1990 levels) and for 2040 (reduction by 72 % compared to 1990 levels). The strategy’s targets and guidelines will be implemented with the help of sector-specific developments plans. Starting from 2019 and at least once every four years, the government will present the Estonian parliament, Riigikogu, with a report considering the main principles of climate policy in the preparation and implementation of cross-sectoral and sectoral strategies (NECP Survey, 2017). Regarding F-gases (fluorinated greenhouse gases), Member States had to put in place training and certification programmes and rules for penalties and notify the Commission of them by 2017. Estonia has notified both measures. The Estonian national strategy on climate change adaptation was adopted in 2017. It calls for eight subgoals in the following priority areas: human health and rescue preparedness, land use and spatial planning, natural environment, bio-economy, economy, society, infrastructure and buildings, and energy and energy supply systems. The

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action plan to implement the adaptation strategy was developed in parallel with the strategy itself and supports its goals and sub-goals. Sectoral mainstreaming is monitored and reported annually through a centralised National Adaptation Strategy (NAS) / National Adaptation Plan report published by the Ministry of Environment. Furthermore, the Ministry of Environment presents an overview of the execution of the NAS to the government once a year. Total revenues from the auctioning of emission allowances under the EU ETS over 2013-2017 were EUR 110 million in Estonia. National legislation states that 50 % of the revenues must be used for energy and climate purposes. 47 % of the auctioning revenues have so far been spent, or are planned to be spent, on climate and energy purposes. A good practice, taking place in Tallinn, is the ‘fix the façade’ programmes to combat climate change.

4.3.2. Environmental policies regarding natural habitats, keeping air and water clean, ensuring proper waste disposal

Nature and biodiversity

Biodiversity strategy

The Estonian government approved the National Biodiversity Strategy and Action Plan (NBSAP) in 2012, with a timeline extending until 2020. By late 2017, 17.9 % of Estonia’s national territory was covered by Natura 2000 sites (EU average 18.2 %), with Birds Directive Special protection Areas (SPAs) covering 13.7 % (EU average 12.4 %) and Habitats Directive Sites of Community Importance (SCIs) covering 17.3 % (EU average 13.9 %). Altogether, there are 567 Natura 2000 sites in Estonia. The latest assessment of the Natura 2000 network shows that the SCI part of Estonia’s Natura 2000 network is almost complete in the Marine Baltic region and close to being complete in the Boreal region. Estonia has designated most of its Natura 2000 sites as special areas of conservation. 348 of them have management plans in place; representing 86.3 % of the total number of Estonian sites. Action plans for seminatural habitats, protected marshes and a number of threatened species have also been established. Estonia’s number of nature-related complaints to the EU is low compared to that of many other countries. Complaints are mainly linked to public participation and assessment of infrastructure projects. Estonian NGOs often manage to handle the complaints at national or local level. Estonia has provided one of the most complete prioritised action frameworks in the EU. It was successfully used to ensure funding for Natura 2000 sites from various EU funds e.g. Rural Development Plan (RDP) and the Cohesion Fund. Estonia has also been active in applying for LIFE funding to manage its Natura 2000 sites.

Air quality

Air quality in Estonia is reported to be generally good, with exceptions. Despite the reduction in emissions, Estonia needs to make additional efforts to meet its emission reduction commitments (compared with 2005 levels) set by the new National Emissions Ceilings Directive for 2020 -2029 and for any year from 2030. For 2017, Estonia did not report any values that exceeded EU air quality standards. However, the European Environment Agency estimated that in 2015 more than 560 premature deaths were attributable to air pollution. In Estonia, around 135 industrial installations must have a permit according to the IED. In 2015, the industrial sectors in Estonia with the most IED installations were ‘other activities’ (55 % of total - mainly intensive rearing of poultry or pigs), energy-power and waste management **(Figure 25).** The energy-power sector was identified as contributing the most emissions to air in Estonia, with pollutants including sulphur oxides (SOx), nitrogen oxides (NOx), particulate matter (PM2.5) and heavy metals. The ‘other activities’ sector (mainly intensive rearing of poultry or pigs) significantly contributes to emissions of nonmethane volatile organic compounds (NMVOCs) and ammonia (NH_3).

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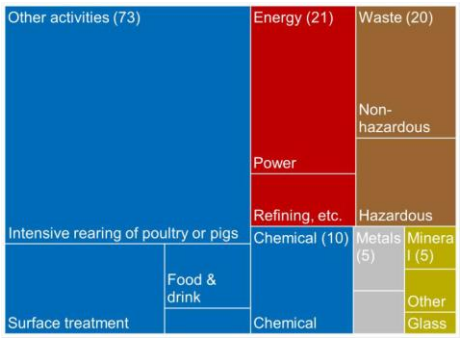

Figure 25. Number of IED industrial installations by sector, Estonia (2015); The EU Environmental Implementation Review 2019 Country Report - ESTONIA

The “other activities” and energy-power sectors contributed the most emissions to water. The energy power, intensive rearing of poultry or pigs and waste management sectors were identified as contributing the most to waste generation. The enforcement approach under the IED creates strong rights for citizens to have access to relevant information and to participate in the permitting process for IED installations. This empowers NGOs and the general public to ensure that permits are appropriately granted and their conditions respected. Best available techniques (BAT) reference documents and BAT conclusions are developed through the exchange of information between Member States, industrial associations, NGOs and the Commission. This ensures a good collaboration with stakeholders and a better application of the IED’s rules. Thanks to the national competent authorities’ efforts to apply the legally binding BAT conclusions and associated BAT emission levels in environmental permits, pollution has decreased considerably and continuously in the EU. For example, by applying the recently adopted BAT emission levels for large combustion plants, emissions of sulphur dioxide will be cut on average by between 25 % and 81 %, nitrogen oxide by between 8 % and 56 %, dust by between 31 % and 78 % and mercury by between 19 % and 71 %.

Water quality and management

Estonia has adopted and reported the second generation of River Basin Management Plans under the WFD and the European Commission has assessed the status and the development since the adoption of the first River Basin Management Plans, including suggested actions in the EIR report 2017. The most significant pressures on surface water bodies were unknown anthropogenic pressure (71% of water bodies) and dams, barriers and locks affecting 25% of water bodies. For groundwater bodies, “no significant pressure” was reported for 77% of groundwater bodies. The most significant pressures were contaminated sites or abandoned industrial sites (point sources 15% and diffuse polution 13%), waste disposal sites (13%) and discharges not connected to sewerage network (13%). The most significant impact on surface water bodies was classified as an “unknown impact type” (58.4% of water bodies), followed by altered habitats due to morphological changes (21%). The situation was similar in groundwater bodies, with 77% of water bodies with reported impacts classified as unknown. The proportion of water bodies in good or better ecological status or potential is 60% for rivers, 67% for lakes and 13% for coastal waters as illustrated in **Figure 26** but there is a risk that the proportion of water bodies in good ecological status is overestimated because of the low confidence in the classification of most of those water bodies.

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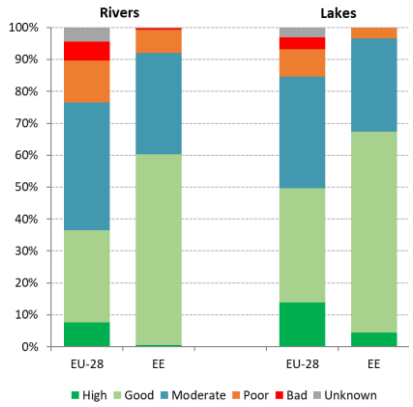

Figure 26. Ecological status or potential of surface water bodies in Estonia; The EU Environmental Implementation Review 2019 Country Report - ESTONIA

A significant proportion of monitoring sites are used for assessment of ecological status (100%, 98%, 80% and 78% of sites for lakes, rivers, territorial and coastal waters respectively) with a considerably lower proportion of sites used for monitoring of chemical status (26%, 38%, 70% and 30% of sites for lakes, rivers, territorial and coastal water respectively). Between the first and second River Basin Management Plans there was a large decrease in the proportion of surface water bodies with good chemical status from 99 to 10% and a significant increase in the proportion with unknown status from 0 to 88%. Methodological changes of the assessment of status as well as increase in the monitoring data available explain the large decrease in the proportion of surface water bodies with good chemical status. 5% of the total groundwater body area is in poor chemical status. 38 out of 39 groundwater bodies (97%) were in good quantitative status and 1 (3%) was failing good status. In terms of area this means that 1% was failing good quantitative status. The implementation of the measures identified in the first Programme of Measures has started but unexpected planning delays, lack of finance, and the lack of a mechanism for implementing measures were identified as obstacles to the implementation. Pressures causing failure of objectives in the WFD have been identified in the second River Basin Management Plans and it is reported that measures have been put in place for most of these. As regards drinking water, Estonia reaches very high compliance rates of 99-100 % for microbiological, chemical and indicator parameters laid down in the Drinking Water Directive.

Floods Directive

The Floods Directive established a framework for the assessment and management of flood risks, aiming at the reduction of the adverse consequences associated with significant floods. Estonia has adopted and reported its first Flood Risk Management Plans under the Directive and the European Commission conducted an assessment. The Commission’s assessment found that good efforts were made with positive results in setting objectives and devising measures focusing on prevention, protection and preparedness. The assessment also showed that, as was the case for other Member States, Estonia’s Flood Risk Management Plans do not yet include a baseline to assess the progress achieved in implementing measures (by extension the objectives, too) and an as complete as possible estimation of the cost of measures. In addition, there is scope for clarifying the method for selecting measures, including the use of cost/benefit analysis.

Urban Waste Water Treatment Directive

Overall, Estonia shows a high level of compliance with the Urban Waste Water Treatment Directive, with close to 97 % of waste water collected and around 90.4 % of it subject to secondary and more stringent treatment. However, a few agglomerations remain non-compliant and the Commission is following up on them with infringement procedures. The estimated investment needed to ensure adequate collection and treatment of waste water in Estonia’s remaining agglomerations is EUR 56 million.

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4.4. Environmental policies in Japan

Policies are well supported by laws and regulation in Japan, and monitoring and enforcement are appropriately applied. The following existing laws and regulations, which promotes and assist improvement of the environmental quality.

- Act on Concerning the Promotion of the Measures to Cope with Global Warming (1998) is the framework for the nation, municipalities, industries, and the public to collectively implement measures against climate change issues in response to the Kyoto Protocol. It articulates roles and responsibilities of each sector in achieving the goal of reducing GHGs by 6% from the level thereof in 1990.
- An Act on Regional Use of Energy (1979), requests factories, which consume massive energy, to report mid and long-term energy saving plan. It was revised in 2008 for further rationalisation of energy use at industries and households, where energy consumption has been increased largely.
- Basic Law for Environmental Pollution (1967) is a law that collectively implements pollution control measures, which articulated responsibilities of the government, municipalities and companies, and determined to take up Polluter Pays Principle. The Law was later merged into the Basic Environment Law (1993).
- Waste Disposal and Public Cleansing Law (1970) defines waste disposal as well as the treatment method and facilities thereof, with a goal of waste reduction and relevant treatment. Under the Law, companies are obliged to treat industrial wastes either by themselves or though the registered waste disposal dealers.

There are several laws related to recycling, such as packing, electronic appliance, vehicles, and computers. Under the Home Appliance Recycling Act, manufactures and importers are obliged to recycle used home appliance, which retailers collect from users and bring in. Obligation of recycling motivates manufactures to design their products in a way they can be easily recycled.

4.4.1. Legislation in the field of green practices

As Japan is one of the more aggressive countries in implementing green growth strategies, the study of Japanese government policies and programs sheds useful light on the practicalities and challenges of creating economic wealth while supporting environmental sustainability.The foundations for Japan’s aggressive entry into the field of environmental technology and green growth business were laid in the 1970s. At that time, through major investments in computing and the automobile sector, Japanese government and industry made substantial commitments to the concept of technology-driven economic growth. Toward the end of the 20th century, the government began investing more broadly in science and technology. The country’s first Science and Technology Basic Plan (1995–2000) reflected the technology-first approach that emerged out of the rapid development of the Internet economy and the global enthusiasm for biotechnology, nanotechnology, and health technologies. The Japanese government had aggressive expectations and used the first plan to improve the country’s basic research infrastructure though heavy investments in university education and basic scientific research. The fourth Basic Plan (2011–2016) describes green innovation (including research into a stable energy supply, low-carbon energy sources, improved energy efficiency, and low-carbon technologies) as one of the keys to the realisation of sustainable growth and societal development into the future. Japan’s current emphasis on environmental and new energy technologies, therefore, is an outgrowth of an evolving approach to science and technology that has shifted the emphasis from scientists and laboratories to consumers and society at large. Act on Promoting Green Purchase was enacted in 2000, and it aims to create sustainable society through the public sectors’ initiatives to promote environmentally friendly goods and services, as well as information sharing. It obliges Ministries and incorporated administrative agencies to develop and publicise green procurement policy and report the implementation results to the Environment Minister, while municipalities are encouraged to develop green procurement policy and to make green

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purchases based on the policy. The Act on Promoting Green Purchase took effect in 2002, although there had been earlier green-purchasing initiatives. The law's goal was to promote environmentally friendly products and services through encouraging government green purchasing, thereby creating a market for the product. Products that met certain eco-friendly criteria were designated as green products. Government departments were encouraged to purchase those items. Green items have been selected in 245 product categories. Municipal governments are also encouraged to purchase environmentally friendly products. In 2007, green purchasing was expanded to include services. In 2011, the Ministry of Environment began revising its green-procurement criteria and expanding its inclusion of, and standards for, electronic goods and public works construction.The Act on Promoting Green Purchasing also aims at building a sustainable society with less environmental impacts. All government agencies and public institutions shall implement GPP for designated procurement items under the Act **(Figure 27)**.

Figure 27. Roles of stakeholders in green purchasing in Japan, Source: Introduction to Green Purchasing Legislation in Japan

At the time the Act was enacted, the market scale of green procurement by national government and agencies was estimated to be JPY 20 trillion, whereas the market scale of Eco Mark certified products in Japan was JPY 4.4 trillion in 2012. It is expected that the market scale of eco-business will reach JPY 58.4 trillion, and the employment will become 1.236 million in 2020. Under the Basic Plan for Establishment of a Sound Material-cycle Society, which targets on green purchases, were set out for municipalities and companies in 2003. As a result, 97% of government at prefecture level and 54% at local level have implemented green purchases**.**

Financing environment related Research and Development

Japan is one of the leaders in R&D, with R&D expenditure well above the average. In 2008, public and private R&D expenditure accounted for 3.4% of GDP, up from 3% in 2000. The business sector funds and carries out over 78% of R&D. High- and mediumhigh- technology industries, such as transport equipment, electronics and chemicals, accounted for some 80% of Japan's exports of manufactured goods in 2007. Japan's number of patent applications is among the highest in the world. Central government outlays for R&D for environmental purposes have slightly increased, although remaining about 1% of the overall government R&D budget. According to the annual Survey on R&D conducted by Japan's Statistics Bureau, 10% of large enterprises invested in environment-related R&D in 2007, and environment accounted for nearly 6% of their R&D budget. Over 70% of these enterprises were in the manufacturing sector. The New Energy and Industrial Technology Development Organisation (NEDO) is the main Japanese organisation charged with targeting R&D with an eye to addressing energy and global environmental challenges while enhancing Japan's industrial competitiveness. NEDO is now the country's largest public research-and-development management organisation. It is an incorporated administrative agency under the Ministry of Economy, Trade, and Industry (METI), and it prioritises and promotes R&D projects on industrial energy (new energy, energy conservation, and fuel cell technologies) and environmental technologies. It also prioritises the promotion of government, industry, and academic cooperation. Its budget comes from METI, and it gives grants to universities, subsidies to private companies, and manages research-and-

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development collaborations among universities, industry, and public research labs. Most of NEDO's budget goes to funding national five-year projects. There are about 70 national projects at one time, and as of 2012 there were close to 50 focusing on energy and environmental technologies. Each project receives about $1–2 billion a year. NEDO often identifies a promising technology or field and then designs a project in which that technology will be showcased. Examples of New Energy and Environmental Technology national projects include initiatives on smart grids, electricity storage technology for next-generation vehicles, fuel cells and hydrogen, next-generation low-pollution vehicles, and water saving recycling systems.

Eco-Innovation Policies

In Japan, MOE and METI are mainly responsible for policies related to the eco-innovation. For some cases, a government authority that deals with city development and public infrastructure is also responsible for the eco-innovation policy in the sector of eco-friendly building materials, which reduce environmental burden and/or increase energy efficiency. Ministry of Land, Infrastructure, Transport and Tourism (MLIT) established the relevant eco-innovation policy instruments to enhance energy efficiency of public and private buildings and to optimise the transportation system of city. In order to put eco-innovation in practice, an integral approach of supply and demand has been adopted; Sustainable manufacturing achieves material and energy savings and enhances efficiency for both supply and demand sides. They are supported by the zero emission-based infrastructure, which consists of a future-oriented energy supply system, environmentally friendly transport system and communities that makes use of the environment industry. Specific plans and programs for promoting the eco-innovation have been developed for sustainable development by establishing the "New growth strategy," "Green Innovation Strategy" and "Strategic Energy Plan". In order to foster the high-technology in medium-long term, "Third Science and Technology Basic Plan" has been operated for capacity building of the eco-innovation of companies. The supportive policies of the eco-innovation in Japan are also established in the technology sector, environmental management and market side. Japan's Top Runner program, launched in 1999, was designed to encourage the development of the most energy efficient electrical appliances. Instead of setting minimum efficiency standards for electrical appliances, the Top Runner program looks for the most efficient model commercially available and makes it the sector-wide standard to be achieved within a specified period of time. As of 2007, there were 21 target products, ranging from passenger cars and microwave ovens to electric toilet seats and vending machines. As the goal is to have more efficient products in widespread use, the energy-efficiency targets are revised every four to eight years. Manufacturers must make the weighted average of the efficiency of all their products of that particular type equal to the Top Runner model by the target year. Top Runner standards are set by committees composed of representatives from industry, universities, labor, and consumer organisations. There are welldefined procedures and variations for products depending on size, power, and weight.

Expanding International Cooperation

The Japan International Cooperation Agency (JICA), the country's leading international engagement institution, began a new program in 2010 to help Japanese companies and NGOs enter so-called Bottom of Pyramid markets with environmental and social businesses. It funds one- to three-year feasibility studies and pilot projects up to 50 million yen (approx. USD 500,000). As of 2012, JICA funded 30 projects worldwide. Japan hopes to contribute to global climate-change efforts through a new METI and MOE-proposed bilateral credit scheme. In 2010, MOE and the Global Environment Centre Foundation launched a feasibility study on the New Mechanism Program. The primary new mechanism being proposed is a bilateral offset credit mechanism. This involves transferring Japanese advanced low-carbon technologies to developing countries and receiving offset credits in return after achieving a real emissions reduction. Japan would contribute to the spread of low-carbon technologies while helping its own companies. This initiative help other countries develop sustainably and achieve their reduction targets. While the Bilateral Offset Crediting Mechanism (BOCM) was not approved by the United Nations Framework Convention on Climate Change (UNFCC) as of 2012, Japan nonetheless launched its first set of new mechanism feasibility studies,

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which include projects from waste management to transportation to energy-efficiency/energysaving projects. Partner countries are primarily in Southeast and South Asia. Japan and Japanese companies are also involved in reducing emissions from deforestation and degradation projects in Indonesia, Brazil, and other countries.

Climate Change

Currently, Japan is a world leader in the development of new climate-friendly technologies. Honda and Toyota hybrid electric vehicles were named to have the highest fuel efficiency and lowest emissions. The fuel economy and emissions decrease is due to the advanced technology in hybrid systems, biofuels, use of lighter weight material and better engineering. The 1998 Act on the Promotion of Global Warming Countermeasures established the Global Warming Prevention Headquarters (GWPH) for the comprehensive, plan-based implementation of global warming countermeasures. The Prime Minister chairs the GWPH, while vice chairmen include the Chief Cabinet Secretary, the Minister of the Environment and the Minister of Economy, Trade and Industry. All other national ministers are members. The GWPH prepares and executes the plan for global warming countermeasures, and co-ordinates their implementation from a long-term standpoint. The Ministry of the Environment (MoE) prepares the National Government Action Plan in line with the Plan for Global Warming Countermeasures and promotes climate change action. Governance on climate change at the local level is ensured by the Regional Committees for Promoting Energy and Global Warming Countermeasures.As a signatory of the Kyoto Protocol, and host of the 1997 conference which created it, Japan is under treaty obligations to reduce its carbon dioxide emissions and to take other steps related to curbing climate change. As a member in the Paris Agreement, Japan was the first nation to release a new National Climate Plan by 2020 as required in the 2015 Agreement. However, this new plan included no major changes from the 2013 National Climate Plan, which aimed to reduce emissions by 26% from 2013 rates. This lack of aggressive action as the fourth-largest polluter in the world led the World Resources Institute to describe the plan as "put[ting] the world on a more dangerous trajectory. In 2018, Japan established its Strategic Energy Plan, with goals set for 2030. The plan aimed to reduce coal use from 32 to 26 %, to increase renewables from 17 to 22-24 %, and to increase nuclear from 6 to 20-22 % of the energy production mix. As part of this goal, Japan announced a goal of shutting down 100 old, low-efficiency coal-fired plants out of its 140 coal fired power plants. As of 2020, 114 of Japan's 140 coal-fired plants are deemed old and inefficient. Twenty-six are considered high-efficiency, and 16 new high-efficiency plants are currently under construction. Japan created the Kyoto Protocol Target Achievement Plan to lay out the necessary measures required to meet their 6% reduction commitment under the Kyoto Protocol. It was first established as an outcome of the evaluation of the Climate Change Policy Program carried out in 2004. The main branches of the plan are ensuring the pursuit of environment and economy, promoting of technology, raising public awareness, utilising of policy measures, and ensuring international collaboration.

Agricultural support

Agriculture is a highly protected and low-productivity sector in Japan. Total support to agriculture, including general services such as education, marketing and infrastructure, decreased during the 2000s. It accounted for about 1% of GDP in 2006-08. Support to farmers also decreased from 58% of gross farm receipts in 2000-02 to 47% in 2007-09. However, support to farmers in Japan remains twice the OECD average. Moreover, support linked to production (*i.e.* to levels of input or output) accounts for nearly 95% of support to producers. This kind of support is generally distortionary and environmentally harmful, since it stimulates production and input use, with negative impacts on the use of water, land, fertilisers and pesticides. Japan needs to reduce its high level of support, moving away from support to production and towards direct support to farmers. Improving the composition of support could bring benefits to farmers, consumers and the environment (OECD, 2009e). In 2007, Japan introduced an agricultural support scheme designed to promote more environmentally friendly farming. To be eligible, producers have to be certified as “eco-farmers”. This involves reducing the use of chemical fertilisers and pesticides by half compared to conventional

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farming. The number of eco-farmers has rapidly increased, reaching 10% of commercial farms. Such rapid enrolment in the scheme would not have been possible without incentives in the form of interest concessions and direct payments. Further expanding the scheme would require additional budgetary support, which was JPY 3 billion (about USD 30 million) a year in 2007 and 2008.

4.4.2. Environmental policies regarding natural habitats, keeping air and water clean and ensuring proper waste disposal

Nature and biodiversity

The Basic Act on Biodiversity was adopted in 2008 providing fundamental policies for biodiversity conservation and sustainable use. This Act requires governments at all levels to develop and implement biodiversity strategies, encourages biodiversity-friendly business activities and describes basic policies for environmental impact assessments. Japan has also taken action to conserve biodiversity, based on legal structures, through the adoption of the Natural Parks Law, Nature Conservation Law and the Law for the Conservation of Endangered Species of Wild Fauna and Flora. Financing for nature conservation remains at a low level. There have been a few initiatives involving fees charged to visitors of nature conservation sites and of payments for ecosystem services. However, Japan should make greater use of economic instruments to finance nature protection and encourage landowners to manage their land to provide ecological services. The National Biodiversity Strategy of Japan (2012-2020) was adopted by Cabinet in September 2012, following two major events: the adoption at the tenth meeting of the Conference of the Parties in Nagoya of the Strategic Plan for Biodiversity (2011-2020), including the Aichi Biodiversity Targets, and the Great East Japan Earthquake that occurred in March 2011 that change the thinking anew about the relationship between human beings and nature. The current Strategy provides a national roadmap for achieving the Aichi Biodiversity Targets, as well as outlines direction for realising a vision of “Living in Harmony with Nature”. It contains 13 national targets and 48 key action goals (accompanied by target years for implementation) whose achievement will be monitored by a set of 81 indicators developed for this purpose. The Strategy also contains around 700 specific measures which will serve as the NAP for implementing the roadmap. With a view to reflecting the views of diverse stakeholders, several enabling activities were carried out (e.g. establishment of a committee of the ministries on the National Biodiversity Strategy of Japan; organisation of townhall meetings nationwide; invitation for public comments; conduct of meetings for exchanging opinions with relevant academic societies and NGOs; consultation with the Central Environment Council). Notably, this is the fifth National Biodiversity Strategy that Japan has prepared in accordance with Article 6 of the Convention. Japan is promoting the revitalisation of traditional rural landscapes (satoyama landscapes), aiming to achieve a balance between farm production and conservation of biodiversity and ecosystem services. The Satoyama Initiative aims to preserve traditional agricultural ecosystems and promote sustainable and organic farming. Indeed, an action plan to enhance measures to revitalise abandoned agricultural land (totaling 396,000 ha in 2010) has been implemented through the collaborative efforts of all relevant organisations and citizens using a mix of both traditional knowledge and state-of-the-art biomass technologies. Efforts have also been made to strengthen marine and coastal biodiversity, through the development and conservation of underwater plant beds and tidelands. In 2007, Japan introduced an Agricultural Support Scheme designed to promote more environmentally friendly farming. Although the overall level of support to agricultural producers is high, environmentally related payments account for only 0,5 % of the total, a very low share compared to many other countries. Measures for the control of the use of living modified organisms have been implemented in accordance with the Cartagena Protocol. The Chemical Control Law has also been amended to minimise the impacts of chemicals on ecosystems. The Government pursues the preservation of gene resources through the Genebank Project, in addition to Programs for the Rehabilitation of Natural Habitats and Maintenance of Viable Populations.

Air quality

Emissions of traditional air pollutants, such as sulphur (SOx) and nitrogen oxides (NOx) continued to decrease during the economic recovery period (2002-07), showing a strong decoupling

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from GDP growth and fossil fuel use. Emission intensities decreased further during the last decade: with 0.2 kg of SOx and 0.5 kg of NOx per unit of GDP (USD 1 000) in 2008, Japan is one of the least pollution-intensive countries. Notable progress was made in reducing emissions of dioxins, especially from waste incineration, as well as transport-related emissions (e.g. volatile organic compounds, carbon monoxide and particulate matter), owing to technological improvements of the vehicle fleet. Nonetheless, air quality in urban areas remains a problem. High levels of photochemical oxidants occur, due to emissions from stationary and mobile sources, as well as from sources outside the country. The management of air quality, as per other key environmental domains, is still largely based on the legal framework developed in the 1970s and in the Basic Environmental Act adopted in 1993. Following the relatively centralised structure of the Japanese government, most of the responsibilities for environmental policy making are retained at the central level. The Ministry of Environment has exclusive jurisdiction over several matters involving air pollution. These include the setting of both ambient air quality standards and emission limits values, the formulation of the total emissions reduction policies and the determination of the facilities to regulate. The annual budget of the MoE almost tripled during the last decade without – however – any large impact on the resources dedicated to air quality issues. Financial resources increased from 356 billion yen in 2000 to 1061 billion yen in 2017 while total staff followed a similar trajectory and grew from 882 to 3,042 persons during the same period. However, this increase – which is mainly driven by the environmental concerns following the Fukushima nuclear accident in 2011 and climate change – is coupled with a constant (or slightly decreasing) pool of resources available for air quality matters. A particular institution is Environmental Restoration and Conservation Agency (ERCA) that manages the programs for pollution prevention and compensation of the sufferers of pollution related illnesses. This agency inherited the pollution compensation programs established during the 1970s-1980s to pay certified victims of air pollution. The agency saw its responsibilities broadening over time to include, among other things, supporting the implementation of measures developed at the central and local level to reduce air pollution. The funding of these activities is generated by a mix of sources, including: the pollution load levy – which is earmarked to pay health compensation benefits – 20% of the total revenues from the automobile tonnage tax and the funds collected though the so-called “specified” levy that is imposed on polluters in the areas where the causal relationship between certain diseases and air pollution is well established, such as the regions of Kumamoto and Kagoshima for the Minamata and Toyama for Itai-Itai disease. Prefectures, the lower level of government, have limited policy-making power in relation to air quality and are mainly in charge of monitoring and enforcement. They can establish stricter emission standards than those set by the central government as in several other OECD countries, they are also responsible for the monitoring and enforcement of air quality regulations and for operating the permitting system. Within this context, they also have the responsibility to warn the public when the concentration of selected pollutants (SOx, SPM, CO, NOx, O_X) reach levels considered as dangerous for human health.

Water quality

The objective of water quality management in Japan is to protect the health of people and the living environment by maintaining a desirable quality of public waters. The desirable status of ambient water quality is defined as the Water Environment Quality Standard (WQES) as designated by the Basic Environment Law. Two types of WQES are set: one is for protection of human health with 26 parameters relating to hazardous substances such as cadmium, cyanide and fluoride; the other is the WQES for conservation of the living environment with parameters and values being differentiated by water bodies and water usages. Parameters and values of WQES are reviewed and revised when necessary, according to new scientific findings and emerging social demands on water quality (Article 16 of Basic Environment Law). At the level of the national government in Japan, responsibilities for the water environment are fractured among a number of ministries: the Ministry of the Environment for water quality; the MLIT for rivers, seas and sewage systems; the Ministry of Agriculture, Forestry and Fisheries for agricultural water and national forests; the METI for industry and industrial water and the Ministry of Health, Labour and Welfare for municipal water supplies. For

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example, the Water Pollution Control Act covers standards for factory effluent, but the MLIT determines effluent standards for sewage treatment facilities. There were some expectations for the Liaison Committee for the Promotion of Sound Hydrological Cycles, established in 1998 and consisting of these ministries, but more effort for the coordination of the ministries is needed. In general, water quality in Japan is good, especially in terms of the protection of human health. The level of compliance with human-health-related water quality standards reached 99.1% in 2005. The level of compliance for river waters with living-environment-related standards in terms of Biological Oxygen Demand (BOD) reached 83.4% in 2005, which reflected significant improvements in water quality since the 1970s. The level of compliance for enclosed water bodies (lakes and reservoirs and sea and coastal areas), which often receive more pollutants from land-based activities around highly populated areas, has shown less improvement than that for rivers. The Clean Lake Law for lakes and reservoirs and the Total Pollution Load Control System for enclosed sea bodies were therefore introduced to attain the desired water quality targets. However, the level of compliance for sea and coastal areas remains at around 70%, the same level as in the mid-1970s. The level of compliance for chemical oxygen demand (COD) values in lakes and reservoirs is only about 50%. Improving the quality of enclosed water bodies is one of the remaining challenges for water environment management in Japan. Infrastructure improvements were previously considered key issues, initially with a focus on improvements in sewer systems and so on, as in the case of the Lakes and Reservoirs Act established to improve the water quality in enclosed water bodies, as well as the measures to achieve total pollution reduction programs for ports and harbors. However, since the year 2000, these regulations have been amended, with the result being the promotion of comprehensive water quality management with special attention given to public participation and the water purification functions of ecosystems such as ‘lake sheds’ and tidal flats.

Policies and laws and institutions for waste disposal and management

In 2000, the Basic Act for Establishing a Sound Material-Cycle Society was enacted to achieve the following purposes: to move away from the current economy system based on mass production, mass consumption and mass disposal, which is facing serious problems, such as an enormous increase in waste resulting from rapid economic development as well as the resulting shortage of final disposal sites; and to promote the establishment of a sound material-cycle society designed to ensure the implementation of 3R (Reduce, Reuse and Recycle). The Basic recycling Act defines the vision of a sound material-cycle society that reduces natural resource consumption and minimises environmental impact. At the same time, the law specifies the order of priority in the management of recyclable resources as well as the roles of different entities (national and local governments, business operators, and consumers). The Basic Recycling Act also legally established, for the first time, the basic principle that recyclable resources should be processed in the following order of priority: generation control, reuse, recycling, thermal recovery, and appropriate disposal **(Figure 28).**

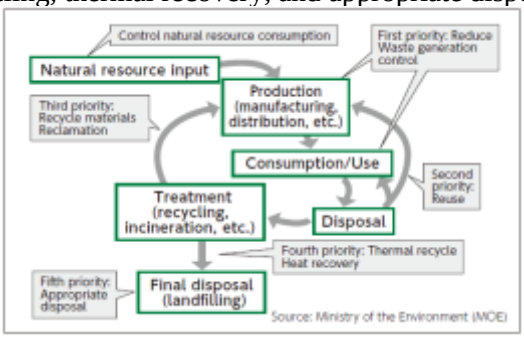

Figure 28. Order of priority for basic recyclable resources

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In defining the roles of different entities, this law distinguishes between the principle of waste generator responsibility, which places the responsibility for the management and recycling of waste on consumers and business operators that dispose of waste, and the principle of extended producer responsibility (EPR), which places the responsibility for the manufacture, design and pot-use management of products on their manufacturers.

The following laws have been developed with a view to establishing a sound material-cycle society:

- The Waste Management and Public Cleansing Act (Waste Management Act), which aims to protect living environments and improve public health through waste generation control and appropriate waste treatment **(Figure 29);**
- The Act on the Promotion of Effective Utilisation of Resources (Effective Resource Utilisation Promotion Act), which aims to ensure effective use of resources, to reduce waste generation, and to preserve the environment;
- Six Recycling Acts that have been enacted in accordance with the properties of individual products – (1) Containers and Packaging Recycling Act, (2) Home Appliance Recycling Act. (3) Food Recycling Act, (4) Construction Recycling Act, (5) Automobile Recycling Act, (6) Small Home Appliance Recycling Act;
- the Act on the Promotion of Procurement of Eco-friendly Goods and Services by the State and Other Entities (Green Purchasing Act), which aims to create a society capable of sustainable development under the initiative of government organisations by promoting the purchase of environmentally friendly products and services.

The Waste Management Act clearly defines the responsibilities of national and local governments, business operators generating waste and other waste generators (consumers) for waste management.

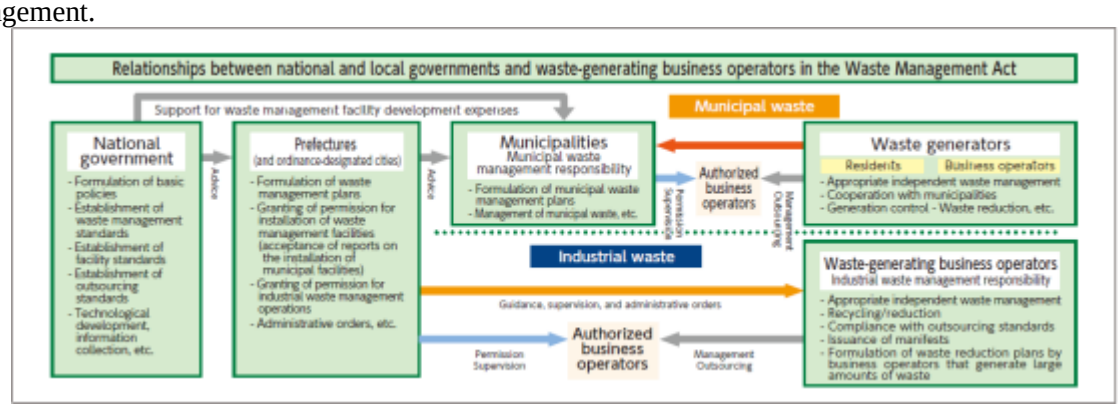

Figure 29. Waste Management Act, Source: History and Current State of Waste Management in Japan

The First Fundamental Recycling Plan was formulated in 2003 to define the image of a sound material-cycle society, including lifestyles in which consumers use good products with great care, as well as environmentally friendly manufacturing and services. The plan was revised in 2008 and the Second Fundamental Recycling Plan aimed to promote integration with initiatives for a low-carbon, environmentally friendly society as well as to create regional circulation networks in order to develop initiatives that meet local resource needs. The plan was revised again in 2013. In addition to conventional strategies focused on the quantity of waste, the Third Fundamental Recycling Plan directed attention to the quality of the use of resources, adopting the following new strategy goals: enhancing initiatives for reducing and reusing waste, which tend to lag behind initiatives for recycling; promoting the recovery of useful metals; enhancing initiatives for security and safety; and promoting international cooperation for 3R initiatives. In Japan organic waste recycling is done through the Food Recycling Law. It was amended in 2007 to promote a recycling loop that requires

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food industries to purchase farm products that are grown using food waste-derived compost or animal feed. In some cities like Kyoto and Hita biomass technology is used.

Effective Resource Utilisation Act

Japan is poor in natural resources and the world currently faces an ongoing depletion of resources. These circumstances make it imperative to move away from a social system designed for mass production, mass consumption, and mass disposal. To that end, the Act on the Promotion of Effective Utilisation of Resources (Effective Resource Utilisation Promotion Act) was enacted in 1991 with a view to ensuring the effective use of resources. The Effective Resource Utilisation Promotion Act mandates that 10 industries and 69 products requiring 3R initiatives be designated by government Ordinance and that specific programs to be independently implemented regarding designated items be developed by ministerial ordinance. The Act also specifies rules about measures to promote 3R in product manufacture and design, identification labeling for sorted waste collection as well as the development of systems for independent waste collection and recycling by business operators.

4.5. Environmental policies in New Zealand

New Zealand’s system of environmental governance is unique in many respects. Although it is a unitary state, the country has largely decentralised regulatory and compliance assurance functions to regional and territorial authorities; NES and rules cover only a limited number of issues. Most environmental impacts are governed by a single comprehensive piece of legislation – the 1991 Resource Management Act (RMA) – which closely integrates land-use planning and environmental regulation. Uncommonly among OECD member countries, the legislation requires individual activity consents or permits only when the activity is not generally permitted under a local plan or by a national environmental standard or regulation. This system was designed to balance the interests of local development and environmental protection. However, since it has often led to inconsistent policy implementation, establishing a regulatory level playing field has become one of the central government’s priorities. Since 2007, New Zealand has made considerable progress in strengthening stakeholder collaboration and engagement with Maori communities at national and sub-national level and implementing recommendations of the previous OECD Environmental Performance Review (2009) in the areas of environmental information and education.

Institutional framework

New Zealand has substantially improved horizontal co-ordination on environmental management at the national level. The Natural Resources Sector (NRS) – a grouping of the eight government agencies under nine ministers with natural resource management responsibilities – was created in 2008 to build a coherent and integrated approach to policy making in this field. The NRS agencies are: Ministry for the Environment (MfE); Ministry of Business, Innovation and Employment; Ministry for Primary Industries, with responsibilities for agriculture and fisheries; Land Information New Zealand; Department of Conservation (DOC); Department of Internal Affairs; Ministry of Transport; and Te Puni Kokiri, the public service department advising the government on policies and issues affecting Maori. The NRS co-ordinates work in several focus areas to align economic development and sustainability goals. These include, for example, issues of freshwater allocation; energy efficiency and use of renewable energy; and urban land management. This unique model of horizontal co-ordination has allowed the government to reduce inter-ministerial tensions, pursue a more holistic approach to natural resource management and work towards an integrated customer service perspective in relation to non-government stakeholders and Maori communities. The NRS has several co-ordination mechanisms: the Business Growth Agenda Natural Resources Ministers Group (for ministers, meets monthly), the NRS Leadership Board (for Chief Executives of member agencies, meets quarterly) and the NRS Programme Governance Group (for mid-level management representatives, meets monthly). The NRS Support Unit, housed in the MfE and jointly staffed through secondments from NRS agencies, ensures day-to-day collaboration across the sector. The Parliamentary Commissioner for the Environment (PCE), who has broad powers to investigate environmental concerns, ensures general oversight of resource management nationwide. The PCE is

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independent of the government and issues high-quality reports to Parliament. The MfE has been the principal national policy-making authority on environmental matters since 1986. The DOC is mainly concerned with management of the conservation estate (i.e. protected areas) and issues permits for activities that could potentially harm biodiversity. The Environmental Protection Authority (EPA) was established in 2011 by a special act. The EPA primarily regulates production and use of hazardous substances and new organisms, environmental effects of activities on New Zealand's continental shelf and transboundary movements of hazardous waste, as well as advises on development proposals of national significance. The EPA's remit covers a mixture of provisions of different statutes, but is only limited to supporting independent decision makers (such as Boards of Inquiry) in permitting major infrastructure projects under the RMA, which is uncommon for a national environmental regulator. There are three types of sub-national (local) authorities: territorial authorities (which include city and district councils); regional councils (which have jurisdiction covering multiple territorial authorities) and unitary authorities (which have powers of both a regional council and a territorial authority). There are 11 regional councils, 61 territorial authorities (made up of 11 city councils and 50 district councils) and 6 unitary authorities, together constituting 78 local authorities. While the idea of merging territorial authorities does not have local political support, local councils are interested in achieving economies of scale through sharing services (e.g. waste management) among neighbouring districts. All local authorities have planning responsibilities, which are closely intertwined with their regulatory powers. Regional councils and unitary authorities have regulatory and enforcement powers for the management of fresh, ground and coastal water; soil conservation; and control of emissions to air, land and water. Territorial and unitary authorities are in charge of land use and have regulatory and enforcement powers in the areas of solid waste management, water supply and wastewater treatment – topics that commonly belong to local authorities responsibilities in OECD member countries. Giving effect to the Treaty of Waitangi requires close collaboration between local authorities and Maori communities (iwi/hapu) over specific important natural resources. All local authorities are primarily accountable to their electorates. Local Government New Zealand, an association of regional and territorial authorities headed by a National Council, supports co-ordination among local authorities. The Upper North Island Strategic Alliance and the Central New Zealand Alliance gather several neighbouring councils in the respective geographic areas. Together, they support collaboration on economic development, transport, tourism, and water and waste management services. Several central government bodies (Ministry for the Environment, Auditor General, Department of Internal Affairs, Ministry of Business Innovation and Employment, and Ministry of Health) oversee local governance functions. The Ministry for the Environment (MfE) oversees local authorities' environmental management activities.

Regulatory framework

Three main statutes govern environmental management in New Zealand: the 1991 Resource Management Act, the 1996 Hazardous Substances and New Organisms Act (HSNO Act) and the 2012 EEZ and Continental Shelf (Environmental Effects) Act (EEZ Act). The RMA – a remarkably comprehensive piece of environmental legislation – provides a framework for national and regional environmental policy development, as well as regional and local planning and permitting. Environmental issues are also integrated into many other statutes that incorporate sustainable development ideas and principles. Over its lifetime, the RMA has been subject to 21 substantive amendments, doubling in size and inevitably losing some of its coherence. The Resource Management Amendment Act 2009 represented the biggest review of the RMA since its inception in 1991. Among other measures, it improved the resource consent process to reduce the cost and time faced by applicants and increased the size of criminal fines for environmental offences. The 2013 RMA amendments further streamlined resource consent applications. The Resource Legislation Amendment Bill 2015 is under consideration in Parliament. Among its aims, the bill seeks to provide more choice over plan making processes and create a more consistent and efficient consent process. These legislative changes should be seen as part of the trend towards reducing the administrative burden for businesses. The regulatory debate in recent years has largely focused on compliance costs borne by

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SMEs and the need to reduce regulatory pressure on them. For example, the Ministry of Business, Innovation and Employment is leading an SME “Good Regulation” project. In addition, a Business Compliance Cost Panel within government looks for ways to relieve the administrative burden; a Small Business Advisory Group represents the SME community in these deliberations.

The RMA: Balancing national direction and decentralisation in integrated resource management

Prior to 1991, New Zealand had complex regulation for resource management characterised by process duplication and a plethora of decision-making bodies with high compliance and transaction costs. With its adoption in 1991, the RMA tried to replace this complex landscape with a “one-stop shop” consent (permitting) system. The RMA was intended to install a regulatory regime establishing non-negotiable “bio-physical bottom lines” to ensure development occurred within the capacity of the environment that supported it. Beyond those bottom lines, resource users would be left to make their own decisions. The RMA’s setup is hierarchical and decentralised, having radically altered the historic resource management responsibilities at all administrative levels. Bottom lines are set at the national level, while regional and territorial authorities implement national directions in the form of National Policy Statements (NPSs), NESs and regulations. The RMA was designed as a framework (for land, air, freshwater and coastal zone management), not a blueprint. It gave local authorities wide discretion to identify the most efficient means of achieving the act’s purpose and meeting community needs. Under the RMA’s hierarchy, regional and territorial policies and plans must give effect to NPSs (i.e. national objectives and policies) and comply with NESs (i.e. technical rules). Other national direction priorities include developing regulations on stock exclusion from water bodies, pest control, aquaculture, natural hazards, end-of-life tyres and dam safety, as well as updating the NPS on freshwater management and NESs on air quality soil contaminants and telecommunication facilities.

4.5.1. Legislation in the field of Green practices

The Government’s package of sustainability initiatives

In February 2007, the Prime Minister outlined her vision for New Zealand to be the first country to be truly sustainable. She announced six new sustainability initiatives. These initiatives are part of a broader cross-government work programme to lead New Zealand towards greater sustainability in resource use and way of life. The six initiatives include helping households towards sustainability, business partnerships for sustainability, eco-verification demonstrating the sustainability of goods and services, sustainable procurement, a carbon neutral public service, and zero waste. The Government has tasked core agencies to implement the sustainability package of six initiatives. The initiatives are being led by Ministry for the Environment or Ministry for Economic Development. Work on the six initiatives sits alongside much existing work to promote sustainability, including:

- The New Zealand Energy Strategy; Released in October 2007 the strategy sets out the Government‟s vision for a sustainable, low emissions energy system and includes an action plan for implementation. The Strategy sets a target of generating 90 percent of New Zealand’s electricity from renewable energy sources by 2025.
- The New Zealand Waste Strategy
- The New Zealand Energy Efficiency and Conservation Strategy; the Plan is targeted at maximising energy efficiency and renewable energy. This is strategy released under the Energy Efficiency and Conservation Act 2000;
- The New Zealand Transport Strategy. The Vision behind the strategy is that, by 2010 New Zealand will have an affordable, integrated, safe, responsive, and sustainable transport system. In 2008, the government will publish an update of the New Zealand Transport Strategy. This Update will provide direction for the transport sector until 2040 in the context of the government’s sustainability agenda and other government strategies in the areas of energy and energy efficiency; translate that direction into high-level targets for the transport sector; provide clearer guidelines for decisions about funding allocations; contain an action plan.

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- The Sustainable Land Management and Climate Change Action Plan. The Plan of Action covers adaptation to climate change, mitigation of climate change additional to the Emissions Trading Scheme and business opportunities arising from climate change. Research, technology transfer and communications is also covered. The Government will continue to develop key elements of this Plan of Action in partnership with industry sectors, local government and Māori.

Voluntary agreements

The central government and local authorities have concluded a number of voluntary agreements with individual companies and industry groups to promote sustainable production practices. The “Sustainable Dairying: Water Accord” – by far the largest one – was put in place in July 2013 (replacing the “Dairying and Clean Streams Accord” of 2003). It establishes national good management practice benchmarks to improve management of risks to freshwater bodies posed by the dairy industry. As recommended by the 2007 EPR, this accord sets clear environmental performance targets and requires regular reporting and third-party auditing. It has achieved tangible results ahead of the adoption of relevant government regulation.

Sustainable public procurement and eco-labelling

The New Zealand government worked closely with its Australian counterpart to produce a joint framework for sustainable procurement (APCC, 2007). In 2013, the two countries signed an Australia-New Zealand Government Procurement Agreement to create and maintain a single government procurement market. The New Zealand government’s Guide to Sustainable Procurement (MED, 2010) suggested compliance with environmental standards as one of the key procurement criteria, largely inspired by the UK model. With support from the New Zealand Business Council for Sustainable Development, a wide range of New Zealand’s government agencies are using these criteria. For sustainable public procurement, government agencies largely rely on the Environmental Choice New Zealand eco-labelling scheme to identify green products and services. The number of companies and products licensed to use this voluntary eco-label has steadily increased over the last decade. Around 2 000 products and services are eligible to carry the eco-label. The Government has substantial capability to influence New Zealanders’ awareness and understanding of green growth through the USD 31 billion procurement activities of 219 State Sector agencies each year. The Government Procurement Reform Programme, established in 2009, is being progressively adopted by government departments, Crown entities, State owned enterprises and local authorities. The Government’s policy on procurement is based around six core principles: best value for money over the whole of life; open and effective competition; full and fair opportunity for domestic suppliers; improving business capability, including e-commerce capability; recognition of New Zealand’s international trade obligations and interests; and requiring sustainably produced goods and services wherever possible, having regard to economic, environmental and social impacts over their life cycle. The Government Procurement is seen as a major opportunity for stimulating greener growth through additional competitive pressure on businesses to opt for increased environmental sustainability in production and supply of a broad range of goods, services, technologies and assets. In their procurement activities, Public Sector agencies can make demands of suppliers aligned with the principle above. The increased weight given to greener supply of the Public Sector can be expected to shape, over time, supply chain requirements and market preferences throughout the economy. It can be used to stimulate upskilling in this area across the Private Sector, with new knowledge and skills spreading through supply chains economy-wide.

Environmentally related taxes

New Zealand has a competitive and efficient tax system. Over 55% of tax revenues are collected through income and profits – the third highest share after Denmark and Australia. The central government collects nearly 90% of general government revenues (only Ireland and the United Kingdom have comparable shares), which indicates local governments have relatively limited fiscal autonomy. Environmentally related taxes are defined as any compulsory, unrequited payment to general government levied on tax bases deemed to be of particular environmental relevance. Most

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environmentally related tax revenue is collected through taxes on consumption of energy products (54%) and vehicle ownership and use (45%). Taxes on pollution and resource use are virtually limited to the waste disposal levy, which accounts for a negligible share of revenue. In 2013, New Zealand introduced the Synthetic GHG (Goods) Levy on imported products containing hydrofluorocarbons (HCFCs) and perfluorocarbons (PFCs) such as fridges, freezers, heat pumps, air-conditioners and refrigerated trailers. Rates are linked to the price of carbon in the NZ Emissions Trading Scheme (ETS) and vary across products to reflect the amount, type and global warming potential of the gas they contain.

Green certification and awards

The number of companies operating in New Zealand certified to the ISO 14001 Environmental Management System (EMS) standard has doubled since 2007. Enviro-Mark Solutions Ltd., a government-owned research institute, has programmes for environmental and energy/carbon certification of both company management and products. Still, with 294 ISO 14001 certificates in 2014, certification levels remain very low. For comparison, Estonia (which has less than a third of New Zealand's population) had 492 such certificates in 2014. The main reasons for low environmental certification levels are absence of demand for it in Chinese and other Asian markets where many New Zealand companies export, but also lack of regulatory incentives (e.g. in terms of inspection frequency) for EMS-certified companies. The Energy Efficiency and Conservation Authority (EECA) Awards are given to organisations and individuals who have demonstrated excellence and innovation in energy efficiency or renewable energy projects. Most regional councils run their own environmental award programmes.

Environmental democracy

There are several opportunities for public participation in the drafting of primary and secondary legislation. In addition, the public can take part in district and regional planning, which provides the regulatory basis for local environmental management. Specific legal provisions implement the consultation rights of the Maori people. Over the last decade, the country has demonstrated progress in promoting broad access to environmental information. Specifically, it has adopted the 2015 Environmental Reporting Act and implemented the Environmental Monitoring and Reporting initiative to improve collection, management and publication of environmental data. The Environment Court provides broad and transparent access to justice on environmental matters. The government actively facilitates access of Maori groups, community organisations and other non-governmental organisations (NGOs) to environmental judicial remedies by covering their legal costs through the Environmental Legal Assistance Fund.

Environmental education

Over the last decade, New Zealand has made further progress in promoting environmental education and incorporating sustainability into the national school curriculum. The Ministry of Education's guidelines for environmental education in schools help teachers identify opportunities within the existing national curriculum statements to plan and provide education in, about and for the environment. The ministry also supports a professional development programme for teachers and many learning-outside-the-classroom projects. A range of programmes run by community groups and environment centres support child and adult sustainability skills education under the MfE's Community Environment Fund and the Department of Conservation's Community Fund. Furthermore, the DOC, MfE and Ministry of Education are jointly developing a national strategy for Environmental Education for Sustainability. The national Enviroschools and Te Aho Tu Roa (for Maori-speaking communities) programmes actively promote voluntary engagement of schools in a "whole school" approach to environmental education; these programmes are co-funded by the MfE, local authorities, local trusts and schools. Since its launch as a national programme in 2001, Enviroschools has continued to grow and expand. To date, over a third of schools and early childhood centres have joined the Enviroschools programme – nearly 1 000 educational establishments covering 250 000 pupils. According to a 2014 nationwide survey of Enviroschools (Enviroschools, 2015), most of them actively engage in actions for water quality and conservation (75% of the schools), waste

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minimisation plans and actions (99%) and energy projects, including actions for sustainable transport and energy conservation actions (69%).

4.5.2. Environmental policies regarding natural habitats, keeping air and water clean and ensuring proper waste disposal

Legislative requirements for biodiversity protection

The legislation underpinning biodiversity protection, management in New Zealand is fragmented and complex **(Figure 30)**.

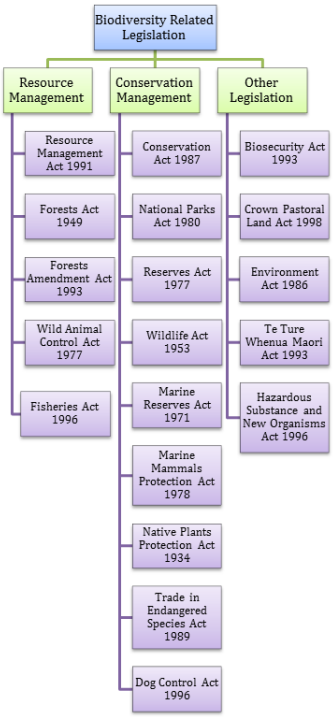

Figure 30. Legislation relating to the protection of New Zealand's biodiversity; Source: Adapted from New Zealand Biodiversity (2007b)

In addition to legislation, a number of national policies guide the conservation, management and sustainable use of biodiversity. The policies and relevant legislation are presented in **Table 1**.

Legislation	Policies
Conservation Act 1987	Conservation General Policy
Resource Management Act 1991	New Zealand Coastal Policy Statement
National Parks Act 1980	General Policy for National Parks
Fisheries Act 1996	Fisheries (South Island Customary Fishing) Regulations 1998
	Kaimoana Customary Fishing Regulations 1998
	Regulation 27 of the Fisheries (Amateur Fishing) Regulations 1986
	Recreational Fisheries Regulations

Table 1. Biodiversity Legislation and resultant policies; Adapted from New Zealand Biodiversity (2007b).

Other than the National Parks Act 1980 and the Reserves Act 1977 which specifically apply to public land, the legislation is applicable to both public and private land. The Resource Management Act 1991 (RMA) is the principal legislative instrument for managing the impacts of resource use (land) on biodiversity (Ministry for the Environment, 2011). The RMA governs the use of New Zealand’s land, air, water, ecosystems and built environment (Ministry for the Environment, 2011). The RMA plays a central role because almost all forms of resource use affect biodiversity. In addition to the RMA, a number of other pieces of legislation are relevant to biodiversity management and conservation in New Zealand: Biosecurity Act; Conservation Act; Forests Act 1949, Forest Amendments Act; National Parks Act; Reserves Act; Wildlife Act.

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In addition to protection through legislation, a number of other initiatives currently influence and impact biodiversity conservation, protection and management. New Zealand has obligations under various national accords and strategies, international conventions, commissions, treaties and is a member of several conservation institutions. The New Zealand Biodiversity Strategy (NZBS) was prepared in response to the growing concern about the state of decline of New Zealand's indigenous biodiversity (Ministry for the Environment, 1997) and to reflect New Zealand's commitment the CBD. The purpose of the NZBS is "to establish a strategic framework for action, to conserve and sustainably use and manage New Zealand's biodiversity" (Department of Conservation & Ministry for the Environment, 2000, p. 2). The NZBS's primary focus is on New Zealand's indigenous biodiversity. However it also recognises the value and economic importance of introduced species. This ensures the genetic resources of these important introduced species are conserved (Department of Conservation & Ministry for the Environment, 2000). A key aspect of the NZBS was the identification of a number of barriers to the effective management of biodiversity. These include: incomplete scientific knowledge of the current status of biodiversity, a lack of effective tools to classify and map different types of ecosystems, lack of consistent methods for monitoring the changes in biodiversity, barriers to information sharing, lack of resources and capacity for the management of resources and biodiversity issues, and lastly, a lack of valuation methods with which to ascertain the true value of biodiversity to enable the development of incentive mechanisms to reward sympathetic management of biodiversity (Department of Conservation & Ministry for the Environment, 2000).The NZBS is overseen by the Department of Conservation. However, its implementation is a collaborative effort shared over seven government agencies: Ministry for the Environment; Ministry of Agriculture and Forestry; Ministry of Fisheries; Ministry of Research, Science and Technology; Foundation for Research, Science and Technology; Te Puni Kokiri/Ministry of Maori Development; and Ministry of Foreign Affairs and Trade.

Regulations over marine protected areas

The network of marine areas under some form of protection has expanded to cover about 30% of New Zealand's marine area (almost 1.3 million km^2). In 2007, the government passed regulations closing nearly one-third of New Zealand's Excusive Economic Zones (EEZ) to harmful fishing practices (e.g. dredging and bottom-trawling) to protect seabed biodiversity. However, many ecosystem types are represented in the marine protected area network only to a limited extent (Brown, 2015). The 2005 Marine Protected Areas Policy and Implementation Plan provided a framework for collaborative stakeholder-led processes to identify networks of possible marine reserves and close gaps in protection. However, by 2014, only three processes had been established. Stakeholder agreement has been difficult to achieve, which has been attributed to the limited array of protection options available under the 1971 Marine Reserves Act, as well as concerns of commercial industries (Brown, 2015). The government's proposal of a new Marine Protected Areas Act aims to provide a wider variety of protection options and improves the process for establishing and managing marine reserves. However, it would apply only to territorial waters (as opposed to the entire EEZ).

Environmental standards

NESs are regulations issued under the RMA that apply nationally. NESs can prescribe technical standards, methods or other requirements for environmental matters. Each regional, city or district council must enforce the same standard, and amend its policy statements and plans to be consistent with NESs. In some circumstances, councils can impose stricter standards than the NES: this has occurred, for example, in several regions with respect to standards for wood burning in households and for discharges from vessels. In addition to the NES for Air Quality (2004), New Zealand has established four more NESs in line with a recommendation of the previous EPR. In the coming years, the government intends to significantly expand the realm of national direction: priorities include developing NPSs on urban development capacity and biodiversity, an NES on plantation forestry and regulations on several other topics. The NES for Air Quality is made up of 14 separate, but interlinked, standards that generally follow guidance from the World Health Organization (WHO). These include seven standards banning emissions of significant quantities of toxic air pollutants and

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five standards for ambient air quality. These standards, implemented through regional air quality plans, include regulatory and promotional measures to address emissions from domestic heating and permitting for industrial emissions; limit values for major industrial sources are usually set by using dispersion modelling. The NES for Sources of Human Drinking Water applies to source water before it is treated and only when the sources supply water to communities, not individual households. The NPS for Freshwater Management requires regional councils to maintain or improve water quality and to set quality objectives and pollutant input limits by 2025 (or by 2030 if it is not practicable to do so by 2025) for individual water bodies based on considerations of human and ecosystem health.

Climate change

While New Zealand accounts for a minor share of global GHG emissions (0.16%), it has been active in international discussions about climate change, acknowledging that all small emitters together generate 30% of global emissions and need to share responsibility for their reduction. The 2002 Climate Change Response Act (and its subsequent amendments) is the framework legislation addressing the country's obligations in the context of the United Nations Framework Convention on Climate Change (UNFCCC). In preparation of the 2015 Paris Climate Conference, New Zealand announced its intended nationally determined contribution (INDC) to reduce GHG emissions to 30% below 2005 levels by 2030. This is equivalent to a reduction of 11% with respect to 1990 levels. The government ratified the 2015 Paris Agreement on 4 October 2016. Under the RMA, local authorities are required to consider the effects of climate change in their planning decisions. The central government supports this process by providing guidance (e.g. through provisions in the New Zealand Coastal Policy Statement) and information (e.g. through a four-year research programme on community vulnerability). The New Zealand Emissions Trading Scheme (NZ ETS), launched in 2008, represents the cornerstone of the country's climate change mitigation policy and the main instrument to achieve its emission reduction targets. Several unique features differentiate the NZ ETS from other emissions trading systems worldwide. These reflect New Zealand's distinct emissions profile (namely, a high proportion of agriculture-related biological emissions and a large amount of forest carbon sinks as well as carbon leakage concerns and the aim of linking the NZ ETS to other markets. The NZ ETS was designed to be a comprehensive scheme that included all gases covered by the Kyoto Protocol and all emitting sectors. It was the first carbon market in the world to include emissions and removals from forestry and agriculture. Forestry entered the NZ ETS at its inception for fear that an announced later entry would encourage deforestation. However, subsequent amendments indefinitely postponed the inclusion of biological emissions from agriculture (methane and nitrous oxide) until technologies are available to reduce these emissions in a cost-effective way and international competitors take sufficient action on their emissions. Stationary energy supply, liquid fossil fuel supply, industrial processes and waste management have all gradually joined the system. As a result, the NZ ETS covers 52% of national emissions (i.e. excluding biological emissions from agriculture). This compares to 45% of the European GHG emissions in the EU ETS and 85% of the GHG emissions in the California and Quebec cap-and-trade systems.

Waste disposal levy and waste charges

The 2008 Waste Minimisation Act introduced a disposal levy (NSD 10 per tonne on waste sent to landfill). The levy aims to increase the cost of waste disposal, thereby changing the price signals associated with waste disposal and potentially promoting waste minimisation, recycling and alternative forms of treatment. However, the levy rate was not set on the basis of the social costs of landfilling; it was primarily designed to generate funding to finance waste minimisation projects at local and national levels. The levy generates about NZD 25 million each year. Half of the levy revenue is redistributed to territorial authorities and the other half feeds the Waste Minimisation Fund (WMF). Most funding available for waste minimisation projects in the WMF is allocated through an annual competition. A 2014 review of the waste landfill levy found that its revenue has supported a broad range of initiatives to minimise waste, although outcomes need to be measured and monitored

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effectively. The NZ ETS, which covers the waste management sector, obliges landfill operators to surrender emission allowances with the aim of encouraging them to invest in any landfill gas-collection system and to separate organic from non-organic waste to reduce methane emissions. New Zealand is one of the few OECD member countries without national regulation of hazardous waste management. The EPA regulates transboundary movements of hazardous waste under the 2011 Import and Export (Restrictions) Act. There are no technical standards for hazardous waste landfills, storage or transportation facilities, either. Disposal of hazardous waste is managed through consents by regional councils using several nonregulatory guidelines from the government. There has been no progress in implementing the 2007 EPR recommendation to introduce national regulations for mandatory and comprehensive domestic tracking of hazardous waste transport, treatment and disposal.

The New Zealand Waste Strategy

The 2010 New Zealand Waste Strategy sets out the government’s long-term priorities for waste management and minimisation, but does not include any quantitative targets. This includes a target requiring all substandard wastewater treatment plants to be upgraded, closed or replaced by December 2020. The Ministry for the Environment partners the New Zealand Water and Wastes Association to develop initiatives which improve the country's environmental performance in the area of wastewater. A number of joint initiatives exist to manage wastewater, among which a list of code compliant contractors and guidelines.

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IV. Waste management: data and strategies. Toxic chemicals and measures supporting the businesses moving towards a more sustainable economic model. Legal assessment of the legislation regarding waste management in the BG-RS CBC region.

1. An overview of waste management: current strategies

1.1. Waste management in Denmark

Waste disposal agreement

The Danish government and a wide majority of the Danish Parliament has entered into an agreement securing a climate-neutral waste sector by 2030, with far more recycling and far less incineration. The agreement will reduce Denmark's GHG emissions with 0.7 million tonnes by 2030, which is equivalent to removing 280,000 diesel and petrol cars from the roads. The Danes have to sort and recycle more waste, and Denmark's incineration plants will import and incinerate significantly less. This will pave the way for significant CO_2 reductions and new circular economy business opportunities. The agreement is the first sub-agreement of a comprehensive climate action plan. The agreement provides Danish recycling companies with better access to recyclable waste. It will support businesses to invest in and develop future green technologies for recycling. Denmark must go from lagging behind to being a recycling world leader.

- *Increased and streamlined waste sorting*. Danish citizens will sort waste the same way at home and at work, regardless of the municipality in which they live. This means that 10 different types of waste must be sorted in all Danish households, and that sorting will follow the same guidelines and waste pictograms.
- *Flexibility for solutions*. The types of waste that can be mixed without degrading the quality can be placed in the same area of the waste bin. The agreement will provide flexibility for municipalities – a standard detached house shall have no more than 2-4 waste bins with several compartments for the 10 waste types. The agreement also provides the opportunity to establish a technological solution, if it can ensure comparable quality in recycling, and the same low level of waste that separate collection involves.
- *More recycling of plastic waste.* A requirement of 60 per cent actual recycling of plastic will be put in place. Furthermore, the agreement requires close sector collaborations with the hospitality industry, agricultural and construction sectors, and in the national implantation of widened package responsibility from manufactures, that have to have financial incentive to make packaging recyclable.
- *A strong recycling sector.* Household and business waste needs to be collected and organised more consistently and uniformly. The framework conditions for the waste sector must be coordinated so investments are put in recycling rather than incineration. The municipalities are required to treat all recyclable waste. Supply obligations does not change the environmental requirements for waste management. Municipalities must be able to document where and how citizens' waste is recycled. Existing municipal facilities can continue to be owned by municipalities for a transitional period of five years, but must be incorporated into the new agreement.

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- *Less incineration and less import of waste for incineration.* The capacity of the Danish incineration plants must be reduced to match the Danish waste volumes, which will decrease as the Danes sort more, so more waste is recycled. Therefore, a capacity ceiling is set corresponding to the Danish waste volumes, which in 2030 is expected to be reduced by approximately 30 per cent compared to today. It has been agreed that the waste sector will henceforth comply with the State's ownership policy. The parties involved agreed, that Local Government Denmark (KL) must provide a concrete plan for capacity adjustment. In the plan, KL will draw up a list of plants that will close according to the capacity ceiling. At the same time, the plan must ensure that the most environmentally unfavourable plants close and improvements implemented to benefit businesses and consumers. KL must deliver a plan by January 1, 2021, which will be sent to approval. If the plan does not meet the set criteria, a supply-based model will take effect instead, where capacity will be reduced through increased competition. If this does not ensure that capacity develops in line with waste volumes, a tax on incineration may be introduced unless another method proves to be more efficient. The agreement will provide a pool of EUR 26.8 million to compensate municipalities for stranded costs.
- *Less waste, more circular economy*. There has to be better opportunity for citizens to deliver waste directly to companies that can use it in production of new products. All municipal recycling sites are obligated to make an area accessible, where citizens can deliver items for direct recycling.
  Source: The Ministry of Climate, Energy and Utilities (in Danish)

The Resources Strategy

With the goals and initiatives in the Resources Strategy, Denmark is expected to meet a number of EU targets, for example those set for packaging and waste electronic equipment, as well as those for more recycling of household waste. The effects of the Resources Strategies are illustrated in **figure 31**. The figure shows changes in the amount of recycled waste, incinerated waste and landfilled waste, with and without the initiatives in the Strategy up to 2018, and then on towards the goal for recycling of household waste in 2022.

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Figure 31. Expected changes in incineration, landfilling and recycling (initiatives in the Resources Strategy excl. construction and demolition waste), Source: Denmark without waste.Recycle more – incinerate less, 2013

With these initiatives, a total of 820,000 tonnes less waste will be incinerated in 2022 than would otherwise have been the case. For example it will mean that around 22,000 tonnes less plastic from households and service enterprises will be incinerated in 2022, giving a total CO_2 saving of just over 25,000 tonnes. Today Denmark already has a number of instruments to promote recycling. There are taxes on landfilling and incineration, but not on recycling. Moreover there is a deposit on cans and bottles, which ensures that almost all of these are returned and can be reused or recycled. Finally there is a treatment requirement for different types of waste of very high concern such as requirements that waste containing PVC must be landfilled and that paper which can be recycled is actually recycled. As part of the Strategy, in the years to come there also will be ongoing analyses of a number of different material flows. If there are environmental, corporate financial and socio-economic benefits from increased recycling, treatment requirements can subsequently be considered, as well as the description of the process for treatment requirements. The amount of municipal waste generated in Denmark is the highest in the EU (758 kg/y/inhabitant compared to the EU average of 475 kg/y/inhabitant) in 2014. This is however partly linked to methodological issue in terms of the scope of definition of municipal waste.

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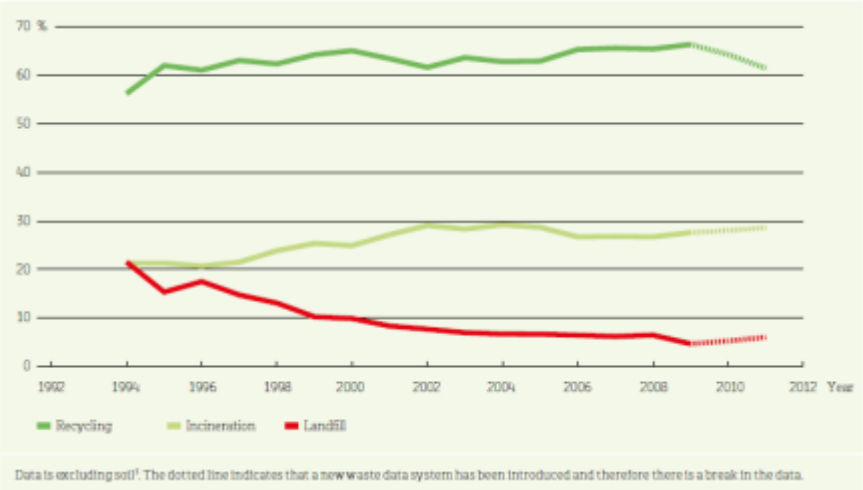

Figure 32. Waste volume and waste treatment trends from 1994-2011

Figure 32 depicts the municipal waste by treatment in Denmark in terms of kg per capita, which shows that recycling remains stable and so does incineration, which is still the main waste treatment operation benefitting from subsidies decided in the past. Denmark has the second highest proportion of incinerated waste (54%) (EU average is 27%) and recycling accounts for 44% in 2014, which is almost exactly the EU average (43.4%). Denmark has one of the lowest proportions of municipal waste landfilled (1%) (EU average is 28%). The low percentage of waste being landfilled is due to a mixture of bans against organic waste in landfills and taxes on landfilling. Denmark still has to step up its recycling rate to achieve the EU 2020 target of 50%. Denmark has taken appropriate steps to improve waste management and implement the current European waste targets. Moving towards the targets of the Roadmap on Resource Efficiency, which outlines how can transform Europe's economy into a sustainable one by 2050, could create Municipal waste and treatment, by type of treatment method. In 2010, the Danish EPA switched to the new Waste Data System to collect waste statistics. The design of the Waste Data System is considerably different from the ISAG Waste Information System it succeeds. Unlike the previous ISAG system, all waste operators, and not only the plants receiving waste, must now report to the Waste Data System. The fact that waste operators must report to the system makes it possible to collect more accurate data about what industry from which the waste originates. They are responsible for ensuring collection of household waste and that there is adequate capacity to treat Danish household waste as well as waste suitable for incineration and landfill which arises in the municipality. Recyclable commercial waste separated at source is subject to market conditions. The majority of the existing landfill facilities are owned by the public sector. Most incineration plants are owned by municipal companies. With regard to recycling, in many cases capacity is ensured by the municipality establishing agreements with private recycling companies. Most types of waste that are recycled are processed abroad, but there are many Danish enterprises – private and public – which separate and pre-treat the waste before it is exported. Irrespective of whether it comes from households or businesses, waste is primarily collected and transported by private companies. Danes want to reuse and help recycle their waste. They are aware that materials must not be wasted and that the hazardous substances in waste must not be spread. Danish recycling sites are very popular. However, many Danes also say that they want to be sure that the time they spend on separating waste is time well spent. Today Denmark incinerates about 80 % of the waste collected directly from households. Recycling a number of ordinary materials such as paper, cardboard, plastic, glass and food from households has not really moved forward for the past ten years. The Government’s ambition is to recycle twice as much household waste, so that one-half of household waste is recycled in 2022. With this Resources Strategy, Denmark will be meeting the EU objective of separating 50 % of “dry” household waste (such as paper, cardboard, glass, plastic and

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metal) in 2020. However, the Government is setting an even more ambitious national goal in which the “wet” organic waste is also included. It is expected to move from only separating 50,000 tonnes of organic waste to reaching up to 300,000 tonnes in 2022. The Resources Strategy therefore anticipates that over the years to come more household waste will be separated and recycled rather than being incinerated at waste incineration plants. Therefore, up to 2022 more household waste will be separated at households and at central separation facilities. A number of municipalities in Denmark have set waste fees according to the amount of waste the individual household delivers for incineration. The waste information system, an EPA responsibility, improved considerably in 2010 with the launch of a waste data system, AffaldsDataSystemet (ADS), and is now based on a waste management register with mandatory reporting from waste collectors, receivers, exporters and importers. Previously only waste treatment facilities reported waste data, with major consistency and quality assurance issues. Waste operators have to provide information about type of waste, treatment and weight as well as the waste's origin and planned treatment and destination. Waste is classified according to European List of Waste codes, and waste producers according to industry or NACE codes. Danish authorities use early checks and control systems to improve data quality and the EPA contacts each reporter individually to help improve reports. The country publishes annual waste statistic reports, which are available to the public. ADS data are complemented by data from the Producer Responsibility System (DPA), for instance on WEEE and batteries. The DPA registers quantities of electrical and electronic equipment placed on the market. Denmark carefully monitors transboundary movements, not only of waste that could pose risk to human health and the environment and waste that should be reported to Eurostat, but also overall waste shipments, including green-listed waste exported for recovery. Copenhagen won the Green Capital Award in 2014. Increasing urban development in Copenhagen with accompanying expansion of the sewer system, as well as increased rainfalls intensity have meant increased pressure on central waste water treatment plants. To minimise this pressure of draining off stormwater in new urban development areas, major renovation work is to be carried out according to the SUDS principles (Sustainable Urban Drainage Systems). Danish authorities have fulfilled all their obligations with regards to the Environmental Noise Directive for the current reporting period. European Commission, 2016 REGIOSTARS finalists. European Green Capital Award, 2011, Good Practice Statement, p.2584 Denmark, Green Living International agreements.

Societies in the common goal

Danes want to reuse and help recycle their waste. They are aware that materials must not be wasted and that the hazardous substances in waste must not be spread. Danish recycling sites are very popular. However, many Danes also say that they want to be sure that the time they spend on separating waste is time well spent. Today Denmark incinerate about 80 % of the waste collected directly from households. Recycling a number of ordinary materials such as paper, cardboard, plastic, glass and food from households has not really moved forward for the past ten years. The Government’s ambition is to recycle twice as much household waste, so that one-half of household waste is recycled in 2022. With this Resources Strategy, Denmark will be meeting the EU objective of separating 50 % of “dry” household waste (such as paper, cardboard, glass, plastic and metal) in 2020. However, the Government is setting an even more ambitious national goal in which the “wet” organic waste is also included. It is expected to move from only separating 50,000 tonnes of organic waste to reaching up to 300,000 tonnes in 2022. The Resources Strategy therefore anticipates that over the years to come more household waste will be separated and recycled rather than being incinerated at waste incineration plants. Therefore, up to 2022 more household waste will be separated at households and at central separation facilities. A number of municipalities in Denmark have set waste fees according to the amount of waste the individual household delivers for incineration. There is a need for an overall assessment of where such models support efficient environmental and socio-economic conversion to more recycling. A lot of garden waste delivered to recycling sites is treated at composting plants, and this means that the nutrients can be recycled as fertiliser.

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Waste from the service sector is similar to household waste and has great potential to contribute to higher recycling rates. This applies for organic waste, paper, cardboard, plastic, metal and glass waste. The following effects are expected from the initiatives in the Resources Strategy: – Twice as much household waste will be recycled (organic waste, paper, cardboard, glass, plastic, wood and metal waste). Today 22 % is recycled and the goal is 50 % in 2022. – Energy recovery from 25 % of garden waste in 2018. Today this figure is 4 %. – Recycling of paper, cardboard, glass, metal and plastic packaging from the service sector increased by 25 %. The level in 2018 was 70 %. – Almost four-times as much organic waste from restaurants, food shops etc. collected and exploited for biogas. Today about 17 % are collected. The level in 2018 is 60 %.

Waste electronic equipment and shredder waste contains many valuable materials, including in particular the 14 resources which the EU has designated as “critical” raw materials. Many of the resources in waste electronic equipment are already being recycled to a large extent, e.g. copper and iron, but many of the critical raw materials are still being lost. This applies in particular to rare earth elements such as neodymium, which is an essential raw material in wind turbines, computer hard discs and electric cars. Environmentally there may be benefits in recycling metals and rare earth elements globally rather than extracting new ore. If the prices on the world markets for these rare earth elements continue to rise, in the long term it will be profitable to recover even small amounts from electronic appliances before they are destroyed. The revised Waste Electric and Electronic Equipment Directive requires that from 2016, waste electronic equipment corresponding to 45 % of the volume placed on the market must be collected. From 2019 the collection requirement is 65 %. The Directive was finalised during the Danish Presidency in 2012 and it is an ambitious objective at EU level. Even Denmark will need new initiatives to increase collection. It entails changing the behaviour of citizens and enterprises. There is already a requirement that manufacturers of electronic equipment and batteries must contribute actively with solutions. A partnership for collection will identify the fractions on which increased collection is to focus, and propose initiatives to increase collection. The first requirement for recycling is that the waste is actually collected. Almost 100,000 tonnes is being collected in Denmark every year. There is a need to focus initiatives so that mobile phones, energy saving bulbs and digital cameras are not incinerated, but are collected separately and recycled.

Shredder waste is composed of old bicycles and cars, for example, which contain hazardous substances, and today large amounts of this type of waste are landfilled. In fact so much is landfilled that shredder waste is one of the largest waste types for landfilling in Denmark. This waste contains resources which could be exploited far more appropriately. The expected effects for waste electronic equipment will be achieved by ensuring effective collection of the waste and at the same time supporting development of technologies which can separate metals and rare earth elements from each other so that they are not wasted. With regard to shredder waste, recycling are supported by the financial incentives in waste taxes on landfilling and incineration and by funding for technological development. The following effects are expected from the initiatives in the Resources Strategy: – In 2018 a total of 65 % of the electrical and electronic equipment placed on the market is to be collected, including 75 % from households. – In 2018 a total of 55 % of the portable batteries placed on the market are to be collected. In 2011, 47 % were collected. – In 2018 more and better shredder waste is to be collected, no more than 30 % of shredder waste is to be landfilled without treatment, and 70 % is to be recovered (minimum 10 % recycling). Partnership between manufacturers, municipalities and registered collectors on collecting small waste electronic equipment, which among other things, will identify the fractions and product categories for increased collection as well as propose initiatives to increase collection.

Denmark leads the world in exploiting the energy resources in waste; exploit the materials resources, where this is profitable. 80 % of organic waste, such as food waste, is water and this is burnt away. **Organic waste** is a valuable supplement in manure-based biogas plants which gasify livestock manure, and it increases their energy production. Supporting biogas production in line with the initiatives to promote biogas in the 2012 energy agreement, exploit valuable plant nutrients such

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as phosphorus and the contents of carbon in food waste, because it can be used as fertiliser. Analyses show that there is a socio-economic efficiency-improvement potential of up to DKK 380 mill. per year for the sector. Today a total of 2.6 mill. tonnes sewage sludge, 32 mill. tonnes livestock manure and 0.7 mill. tonnes organic waste are produced. Together this waste contains around 50,000 tonnes phosphorus. There is a potential to exploit the phosphorus in the ash arising from incinerating sewage sludge and to be more targeted in exploiting the phosphorus in livestock manure so that it is absorbed by crops without impacting the soil and aquatic environment with excessively large amounts of nutrients which are not absorbed by the crops. The Strategy supports increased exploitation of important and critical nutrients such as in waste with a particularly high phosphorus content.

Improved quality in **recycling construction and demolition waste** Construction and demolition waste accounts for by far the largest percentage of total waste volumes; about 87 % of construction and demolition waste is recycled. Much of construction and demolition waste contains hazardous substances. Therefore it is important to remove these substances so that they are not spread into the environment and be aware of new substances which may pose a risk for the environment and health. The initiatives regarding waste in the 2011 PCB Action Plan are being implemented so that construction and demolition waste containing PCB is managed to ensure better quality recycling. The Resources Strategy therefore focuses the aims of the PCB Action Plan to improve the quality of recycling. There is a need to improve management of the often mixed waste materials. There is also a need to secure better quality of the demolition materials which are crushed and used as a substitute for gravel and stone in roads. This may mean that recycling drops for a period. This drop has already been apparent over the past couple of years in line with increasing awareness of PCB. In the long term recycling rate will again increase, but such that it does not impact the environment by spreading hazardous substances. However, there are also other substances harmful to the environment in construction and demolition waste, and these provide potential for better and safer recycling. In the years to come Denmark will be facing the largest ever expansion of wind turbines. This means that many smaller wind turbines will be pulled down to be replaced by new, larger turbines. This is a result of the government goal for 50 % of electricity production to come from wind energy in 2020. Therefore it is important to find the best possible way of ensuring that end-of-life wind turbines are used and exploited as a resource.

1.2. Waste management in Portugal

Concerning **waste management**, material and energy recovery has improved steadily over the years as a result of the policies implemented. A set of planning instruments is now under revision, in particular the Waste Management Tax and the licenses for waste and material flows. The Strategic Plan for MSW for 2020 was recently approved. There were many sectoral policies that were published or revised in 2014-2015. In 2014 the PERSU 2020 (National Plan for MSW Management 2014-2020) was published. Its main objective is to set the roadmap to meet the 2020 EU targets for MSW, namely the 50% objective for preparation for reuse and recycling. The PERSU 2020 translates this into differentiated regional objectives that take into account the different characteristics of the MSW management systems (e.g. population density and per capita production). To help meet the targets, PERSU 2020 proposes a large set of measures aligned with eight strategic objectives. A revised plan with a more forward looking perspective (PERSU 2020+) is under preparation. Thus, waste management in mainland Portugal is currently based on the following solutions: Separate collection of packaging waste, paper and other recoverable waste streams (door-to-door, ecopoints, ecocenters) for sorting and shipment to recycler; separate collection of BMW for organic recovery through composting and/or anaerobic digestion processes; undifferentiated collection of municipal waste for shipment to Mechanical Treatment and/or Mechanical and Biological Treatment for later shipment to recycler or another recovery process; undifferentiated collection of urban waste for shipment to energy recovery (waste incineration); landfill waste deposition of non-recoverable fractions or direct deposition. Portugal also has a substantial amount of MBT capacity for treating residual waste. The bio-stabilised outputs from this system are also counted towards the recycling targets, which explains the relatively high composting rate. However, this possibility will be phased

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out from 2027 in accordance with the revised Waste Framework Directive (WFD). Recent assessment of the PERSU 2020 examined specifically the barriers linked to the overreliance of the waste management system on MBT facilities. Opportunities for waste prevention and recycling are thus not yet fully developed in Portugal. The proportion of incinerated and landfilled municipal waste, which remains high, is holding back the transition to a circular economy. For instance, a particular focus has to be made on the Azores Islands in supporting waste prevention and recycling. Portugal will have to expand the separate collection of municipal waste and move away from a model that overrelies on sorting mixed waste, especially if it is to progress towards meeting the new recycling targets (55 % by 2025, 60 % by 2030, 65 % by 2035).

1.3. Waste management in Estonia

Over the last decade, Estonia has successfully transformed its municipal waste management practices from landfilling to a high level of waste incineration **(Figure 33)**. It has made progress in recycling, particularly in Tallinn. Since 2005, Estonia’s municipal waste management has moved from reliance on landfilling to a high level of energy recovery via waste incineration. In 2008, Estonia required municipalities to separate collection of paper and cardboard, garden waste and hazardous waste from households and small businesses. In 2012, Tallinn separated 53% of all collected MSW, the third highest among EU capital cities: it collected 85% of discarded glass and 74% of paper waste.

Figure 33. From landfilling to incineration and recycling

Turning waste into a resource is supported by: fully implementing EU waste legislation, which includes the waste hierarchy, the need to ensure separate collection of waste, the landfill diversion targets, etc.; reducing waste generation and waste generation per capita in absolute terms; and limiting energy recovery to non-recyclable materials and phasing out landfilling of recyclable or recoverable waste. The amount of municipal waste generated in Estonia **(Figure 34)** kept increasing from 280 kg per capita in 2012 and amounted to 390 kg per capita in 16 2017. It remained below the EU average of 487 kg, however. In addition, Estonia uses an index to measure the growth rate of municipal waste per capita in relation with the growth rate of the GDP where the trend was more positive, as waste generation grows slower than GDP. Despite the shift form landfilling to incineration, recycling rate has also increased. A recent study assessing separate collection in EU capitals rated Tallinn as the second best performing capital in the EU.

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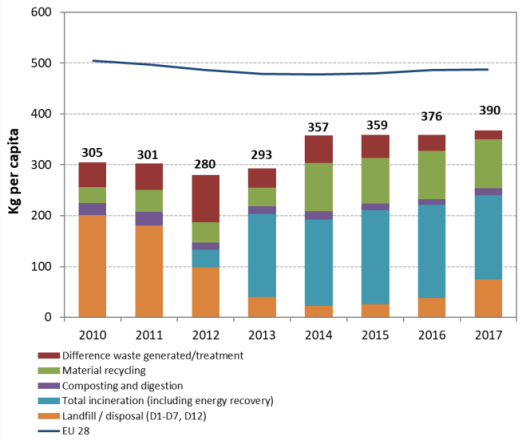

Figure 34: Municipal waste by treatment in Estonia 2010- 2017, Source: Environmental Implementation Review 2019 – Estonia

The Government's new waste management plan for 2014–2020 mainly focuses on modern product design, clean resource-saving production and the recycling of already produced materials. It also discusses moving away from the model of municipal waste management based on tendering towards a free-market approach. The plan also includes Estonia's Waste Prevention Programme. Full implementation of the existing legislation could create more than 1.300 jobs in Estonia and increase the annual turnover of the waste sector by over EUR 140 million. Moving towards the targets of the Roadmap on resource efficiency could create over 1.600 additional jobs and increase the annual turnover of the waste sector by over EUR 174 million.

1.4. Waste management in Japan

Waste management in Japan today emphasises not just the efficient and sanitary collection of waste, but also reduction in waste produced and recycling of waste when possible. Japan is a mountainous and highly volcanic country with only 10 percent land suitable for residential purpose. The shortage of land limits the availability of suitable landfill sites and is a driving force behind waste management policy. It has taken a number of measures to reduce the per capita waste generation or to make it constant. The policies are based on the 3R approach of waste reduction, reuse and recycling to minimise the waste that ultimately destined for landfill and the main route for waste disposal is incineration. According to Statistics Bureau of Japan, the quantity of average MSW production declined from 1.18 kg in 2000 to 0.97 Kg per capita per day in 2010. It generated around 52 million tonnes of MSW in 2000, 77.4% of which was incinerated, 5.9% landfilled and 16.7 % recycled. In 2010 the MSW quantity reduced to 43 million tonnes out of which 79 percent incinerated, 1.5% landfilled and 19.4% recycled. According to Ministry of Environment, Government of Japan, the daily per capita waste was 1.18 kg in 2000 which decreased to 1.08 Kg in 2007, reduced by 8.1% from 2000 **(Figure 35)**.

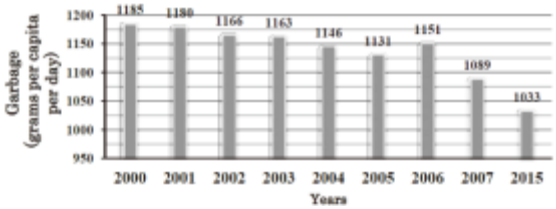

Figure 35. Waste per capita per day in Japan, Source: Ministry of Environment, Govt. of Japan, Establishing a Sound Material-Cycle Society, 2010

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Japan controls the generation of waste at source by households, where the waste originates. The concept of *shared responsibility* has been effectively used. Citizens are supposed to separate the waste into combustibles, non-combustibles and recyclables (can, glass bottles, PET bottles each sorted separately). They should deposit the waste in specified transparent bags, at the locations specified by the municipalities on a particular day of the week by a specific time. Both municipalities and waste disposal agents sort out useful components of the collected waste and put them into a recycling route. To encourage voluntary recycling activities, municipality plays an active role through its various programmes. In Japan, public trash cans are quite rare, having been removed from public spaces in the aftermath of the 1995 Tokyo Subway Sarin Attack. Usually, trash produced outside is brought home and sorted with household trash before collection. Trash is sorted based on regulations that vary by municipality into as many as thirty different categories. In urban areas, garbage collection is usually done by small compacting garbage trucks which convey garbage from producers and bring it to centralised transport stations, where it is then delivered by a larger truck to a disposal or incineration site. This approach is used to minimise redundant trips and because smaller trucks can better navigate narrow urban roads. One area of innovation is the development of hybrid or electric motor trucks which produce less pollution and GHG. In the collection business, there has been a recent trend towards privatisation, with 80% of collection across Japan being done by private companies amidst public-sector cutbacks. In rural Japan, where there is no curbside collection, residents bring their own trash to neighborhood collection centers. Recycling has been an increasing emphasis for waste disposal in Japan since recycling acts were passed in the 1990s. In 2014, the Resource Recycle Rate, the ratio of total material inputs into the economy and the amount recycled into raw inputs was 15.8%. In contrast, this figure was 8.2% in 1994. Different categories of recyclable items can be evaluated individually. Japan is one of the top aluminum beverage cans recycling countries in the world, with a ratio of 84.7% recycled in 2014. Steel cans are also recycled at a higher rate in Japan, 92.9% in 2013, than anywhere else in the world. The plastic recycling picture is a bit more complicated. The government reports an 84% recycling rate, one of the highest in the world, but this includes thermal recycling, where plastic is burned for energy. Only 27% of collected plastic is reprocessed into usable material. Thermal recycling is criticised as not being true recycling, as it still encourages the use of single-use plastics and produces greenhouse gases. Solid wastes that cannot otherwise be processed, residues and other materials that are discarded after processing are ultimately disposed of by methods like sanitary landfilling or incineration. 75 % of MSW generated in Japan is being treated by incineration. In 1990s the burring of waste in incinerators raised dioxins to dangerously high levels in Japan, but technological advances have since corrected the problem. In Japan, now the plasma arc technology (PAT) is used for incineration. It helps in more than 95% volume reduction of thrash. PAT works at a very high temperature and can decompose more than 99.99% of the organic components. In the process, the dioxin formation is prevented and the clean gases are released into the atmosphere. PAT is a capital intensive technology.There are more than 1800 incinerators in Japan and 13 alone are located in Tokyo. Japan has combined incinerators with energy recovery plants to achieve the dual objective of waste disposal and energy generation. For example, some Japanese cities have integrated their MSW incinerators in community complexes with indoor gardens, meeting halls, second hand shops and offices of NGOs. Tokyo’s Toshima incinerator burns 300 tonnes of garbage per day, turning it into electricity, hot water and recyclable sand. Backfilling or land reclamation is the process of filling in the sea with processed trash to create land that can be developed. In Tokyo, this has taken place since the 1920s and continues today. One contemporary example is the Central Breakwater, an artificial island in Tokyo Bay. In 2014, 21 million tons of garbage were put towards this purpose.

1.5. Waste management in New Zealand

Currently, the main strategy adopted by New Zealand’s government regarding its waste management strategy is to reduce, recycle and reuse waste. Most of the non-recyclable and/or non-reusable waste ends up in landfills. The waste issue in the country is recently worsened by China’s decision in 2017 to restrict imports of plastic, which directly impacts the 30,000 tons of plastic waste

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New Zealand used to export annually. Its waste generation per capita is currently among the highest in the OECD. The size and low population density of the country make recycling an economically difficult business. To encourage recycling, the government has accredited 14 voluntary product stewardship schemes. Waste management practices differ across local authorities. Several local councils have launched programmes and regulations aimed at promoting recycling. For example, recycling requirements have helped the Wellington region reduce the amount of waste going to landfills by 15% in five years. Some cities apply quantity- or volume-based waste charges, which provide incentives to households to reduce waste. Evidence from the Auckland region indicates that districts applying volume-based charges send nearly half of the waste volume to landfills than districts financing waste management through flat charges included in property taxes. This is consistent with experience from other countries (e.g. Germany and Korea). Quantity- or volume-based waste charges could be more extensively applied to encourage waste minimisation and recycling, and finance advanced waste management services. In a welcome step, the first Auckland-wide Waste Management and Minimisation Plan (adopted in 2012) introduced a coherent funding model for household waste management, which features the polluter pays principle as a key component. The proposed model charges by volume for collection of unsorted household waste; recycled household waste would be financed through rates and/or other funding sources. The rationale behind this scheme is to encourage households to recycle the maximum possible. The amount of funding sourced through rates is expected to remain equal to current levels (Auckland Council, 2012b). Waste charge revenue will partly feed the Auckland Waste Minimisation and Innovation Fund, a major initiative under the Waste Management and Minimisation Plan. To date, NZD 1.4 million has been awarded to 162 projects across four priority areas (resource recovery, commercial waste, organic waste, and community action and behaviour change). New Zealand collects waste information (tonnes disposed) from facilities that have responsibilities under the Waste Minimisation Act 2008; that is facilities that accept household waste and operate at least in part as a business. The majority of waste material that ends up in landfill is generated by commercial activity and industry. In the Auckland region it is estimated that about 85% of landfilled waste comes from these sources. Unlike MSW, commercial and industry waste is controlled almost entirely by private waste companies. There are approximately 52 municipal landfills that accept household waste in New Zealand spread across the North, South and Chatham Islands. There has been a significant closure and upgrading of landfills in the past 10 years, in 2002 there were 115 landfills operating across New Zealand. Despite the increasing waste generation, emissions from waste management decreased, owing to better management systems of landfilled waste (improved methane recovery). All local authorities offer drop-off collection services for recycling, and some have adopted recycling requirements or quantity-based waste charges, which helped reduce waste volumes going to landfill. However, many authorities still lack strong incentives to change household behavior.

2. Toxic chemicals and measures supporting the businesses moving towards a more sustainable economic model.

Society benefits from using chemicals while aiming to minimise risks to the environment and human health. Chemicals are widely used in everyday life and many economic sectors are dependent on chemicals, such as agriculture, manufacturing of consumer products, infrastructure and technology, and energy. Emissions of chemical pollutants occur across various stages of the chemical or product's life cycle and exposure to chemicals may occur through many routes, including point and diffuse sources. Chemicals produced or used in one place may also spread regionally and globally. The toxicity of hazardous substances depends on both the chemical and the vulnerability of humans or ecosystems when exposed. For example, if an organism is exposed during fetal development, or exposed to multiple stresses, this can increase vulnerability, meaning that the chemical is hazardous even at low doses.

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Persistent chemicals have high intrinsic molecular stability and do not easily degrade in the environment or in living organisms or during technical processing. Persistent organic pollutants (POPs) is a specific subcategory, with polychlorinated biphenyls (PCBs), per and polyfluorinated alkyl substances (PFAS) and organomercury being examples.
Mobile chemicals are either very water soluble or very volatile making them difficult to remove with abatement and remediation technologies.
Accumulation occurs in the environment or in humans if the rate of input exceeds the rate of removal.Bioaccumulation occurs when chemicals accumulate in living organisms, typically due to a long-term intake of food or water contaminated with chemicals that are not efficiently removed from the organism. Accumulation of fat soluble chemicals occurs in fatty tissues (e.g. PCBs and dioxins), but chemicals may also accumulate in the blood and organs (e.g. PFAS).
Endocrine-disrupting chemicals (EDCs) interfere with the development or the functioning of the hormonal system such as the female sex hormones (oestrogens), male sex hormones (testosterone) or thyroid hormones.
Examples include bisphenol A (BPA) and phthalates (e.g. di-(2-ethylexyl) phthalate, DEHP).
Developmentally toxic chemicals damage the development and future functioning of the endocrine (hormonal) system, the immune system or the neurological system (affecting brain development). Critical windows of exposure are associated with different stages of the development of an organism. Definitions of key terms immunotoxic substances, whereas lead, organomercury and organophosphate pesticides are examples of neurotoxic chemicals.
Substances of very high concern (SVHC) is a term used in the EU chemicals regulation REACH (registration, evaluation, authorisation and restriction of chemicals), for single or groups of chemicals that are subject to authorisation. EU legislation requires that SVHCs should be substituted with less harmful alternatives and the REACH Regulation provides for risk management processes to achieve this aim. The SVHC criteria target substances that have one or more of the following properties: carcinogenic; mutagenic; toxic for reproduction; persistent, bioaccumulative and toxic (PBT); very persistent and very bioaccumulative (vPvB) or giving rise to equivalent levels of concern. Examples of the substances causing equivalent concern include neurotoxic and endocrine-disrupting chemicals.

Overall risks result from the combined exposure to single chemicals released from various sources but also from mixtures of chemicals. High exposure typically happens as a result of repeated exposures and when chemicals accumulate in the environment or in people. Accumulation occurs when the input of chemicals is greater than the rate at which they are degraded or excreted from living organisms. This may occur with chemicals produced at high volume that are continuously released into the environment at a rate that exceeds the removal rate, as well as with lower volumes of persistent chemicals. Between 2000 and 2017, the production capacity of the global chemical industry increased from 1.2 to 2.3 billion tonnes (UNEP, 2019). In terms of diversity, 22 600 chemical registrations were registered under the REACH legislation in August 2019. This number omits chemicals on the market at volumes of below 1 tonne, as well as polymers, and those already regulated under existing regulation such as pesticides and pharmaceuticals. The total number of synthetic chemicals on the market has been estimated at 100 000 substances (Milieu Ltd et al., 2017) and 600 000 substances can be searched in toxicological databases (DTU, 2019). There are also an unknown number of transformation products from chemicals during their life cycles (Ng et al., 2011). At the same time, the volume and diversity of chemicals continues to increase (CEFIC, 2018). In the EU, 282 million tonnes of industrial chemicals were produced in 2017. Of these, 28 %, or 75 million tonnes, were hazardous to the environment and 75 %, or 209 million tonnes, were hazardous to health. The proportions of chemicals hazardous to the environment and/or hazardous to health remained stable from 2008 to 2017 (Eurostat, 2019). The consumption of industrial chemicals in the EU in 2017 was 304 million tonnes. Of these, 22 % were hazardous to the environment and 71 % were hazardous to health, similar proportions to those for chemical production. The proportion of consumed chemicals hazardous to the environment declined by 5 % from 2008 to 2017, with a decline of 6 % for chemicals hazardous to health, suggesting a downward trend in the overall hazard posed (Eurostat, 2019). However, the information available on chemical hazards is incomplete and the classification criteria under the CLP Regulation do not effectively capture certain health impacts, in particular long-term developmental toxicities associated with endocrine disruption, neurotoxicity and immunotoxicity, as well as certain categories of chemicals hazardous to the environment, such as persistent, bioaccumulative and toxic (PBT) and very persistent, very bioaccumulative substances. For more than a century the chemical industry has led innovations in areas including pharmaceuticals, plastics and consumer electronics that have transformed the way people live around the world. In particular, the period from the 1950s through the 1970s witnessed a wave of innovations in chemistry, with dozens of new chemicals and compounds discovered and commercialised. From 1980, however, new product development slowed down and few new blockbuster chemicals entered the market. During that time

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the global chemical industry focused on expanding to new markets, often selling chemicals invented long before such as polyvinyl chloride (invented in 1913), polyethylene (1936) and polypropylene (1954). Return on investments from growth in new markets was more attractive than the return from (Sarathy, Gotpagar and Morawietz 2017). Today this situation is evolving. Lower profits from bulk chemicals, recent innovations in chemistry and advanced materials, and the challenge for the chemical industry to help meet the Sustainable Development Goals (SDGs) are creating new opportunities for chemistry to help meet society's needs. Examples are numerous and include the following:

- *Revolutionising energy storage and battery development:* Fast-charging solid-state batteries, based on chemistry innovations, have the potential to revolutionise electric mobility. Not only can they be charged 10 times faster than traditional lithium-ion batteries, but they are safer as they cannot catch fire, are more reliable and are longer lasting.
- *Improving the biodegradability of bio-based plastics:* Biodegradable plastics, derived from agricultural or wood-based biomass, are compatible with home and municipal composting systems, have less environmental impact and can be incorporated into composting infrastructure. They can also form feedstocks for bioenergy and other circular economy applications.
- *Creating sustainable building materials:* Chemistry plays a key role in creating a new generation of sustainable and high-performing building materials. Examples include transparent wood, green concrete, wood foam insulation, and earthquake resistant bricks.
- *Turning carbon dioxide (CO_2) and wastes into chemical feedstocks:* Creating feedstocks that are not fossil fuel-based from CO_2 using renewable energy not only reduces GHG emissions; it also advances circularity in the chemical industry by providing chemical feedstocks that are not derived from oil or bio-based materials.
- *Developing "advanced materials":* This involves developing materials and modifying existing ones to obtain superior performance in regard to one or more characteristics that are critical to the application under consideration, such as waterproofing textiles. These materials can also have completely novel properties, as seen, for example, in nanomaterials.

Research across the disciplines of chemistry, biology and computer science is particularly promising. The 2018 Nobel Prize in Chemistry, for example, was awarded for path-breaking research on how chemists produce new enzymes, leading to new pharmaceuticals and cancer treatments and less waste. Another promising development is the use of advanced software and supercomputers to design molecules and assess the properties of chemicals, including their hazards. These developments have significant potential to advance the sound management of chemicals and waste, and to complement other measures in order to achieve sustainable production and consumption.

Green and sustainable chemistry as an evolving benchmark

Knowledge, assessment tools and legislative instruments are available and used in many countries, albeit not globally, to ensure that new substances which may have adverse impacts on health and the environment do not reach the market. Furthermore, more detailed criteria are becoming available to assess the extent to which a chemistry innovation is fully compatible with the three pillars of sustainable development (economic, environmental and social). The concepts of green chemistry and sustainable chemistry provide promising guidance in this regard. At the end of the 1990s Anastas and Warner defined green chemistry as "the utilisation of a set of principles that reduces or eliminates the use or generation of hazardous substances in the design, manufacturing and application of chemical products" (Anastas and Warner 1998). They also proposed 12 Principles of Green Chemistry. In a related development in Europe, similar principles were included in the Council Directive on integrated pollution prevention and control (European Commission [EC] 1996). Research related to green chemistry has made possible a wide range of developments in the fields of bio-based chemicals, renewable feedstocks, safer solvents and reagents, atom economy, green polymers, and less toxic chemical formulations (Anastas and Warner 1998; Philp, Ritchie and Allan 2013). As a spin-off from work on green chemistry, a set of nine Principles of Green Engineering, now known as the Sandestin Declaration, were developed in 2003 (Abraham and Nguyen 2003).

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Other important developments compatible with green chemistry include the European Communities Chemistry Council 1993 report on “Chemistry for a Clean World”, conferences on the concept of Benign by Design (Linthorst 2010), and the development of related concepts such as cleaner processes, safer products, and the use of renewable feedstocks (Clark 2006; Mubofu 2016).

Business models in a fast-changing world

In a fast-changing world, new business models with direct implications for the chemical industry are evolving rapidly – providing opportunities to advance sustainability by increasing resource efficiency, and by reducing the use of hazardous chemicals and chemical pollution. Business model innovations for sustainability may be defined as creating “significant positive and/or significantly reduced negative impacts for the environment and/or society, through changes in the way the organisation and its value-network create, deliver value and capture value or change their value propositions” (Bocken *et al.* 2014). Business models that have a strong focus on sustainability and circularity include green product- and process-based models, waste regeneration systems, efficiency optimisation, management services, and industrial symbiosis models (Beltramello, Haie-Fayle and Pilat 2013). Other emerging business models, such as consumer-centric models and social enterprises, are directly driven by sustainability considerations but are equally relevant to the sound management of chemicals and waste.

Service-based systems, including Chemical Leasing

Service-based business models, or “product-service systems” (PSS), are an alternative to the traditional sales concept of industrial production. PSS can be broadly defined as “a combination of products and services in a system that provides functionality for consumers and reduces environmental impact” (Hänsch Beuren, Gomes Ferreira and Cauchick Miguel 2013). This means goods continue to be owned by the provider(s). What a PSS customer actually purchases is the functionality or performance of the goods in the form of a service. A business that offers a service does not seek to maximise sales of a chemical product, but to provide the service in a cost-effective and sustainable manner.

Chemical management services: win-win opportunities

In the chemicals sector PSS are referred to as “chemical management services” (CMS). CMS generally involve a strategic, long-term contract between the service provider and the client. The service provider is compensated based on the quality and quantity of the services provided, rather than on the volume of chemicals sold. Proponents of CMS note that the service provider and customer have the same objective: to reduce the overall life cycle costs of chemicals management (United Kingdom Chemicals Stakeholder Forum 2013). CMS services may encompass (and be provided at) all stages of the chemical life cycle, including production, transport and storage. CMS can help reduce the risks associated with the production and use of chemicals. They can also stimulate sustainable production and a decrease in product consumption levels (Askar 2006).

Chemical Leasing: a successful application of CMS

Chemical Leasing is a type of CMS whereby “the functions performed by the chemical serve as the unit of payment and chemical suppliers and users work together to optimise chemical use in fulfilling the function” (Joas, Abraham and Joas 2018). Responsibility for the application, handling, storage and disposal of chemicals is thus shifted from the user to the chemical supplier. The supplier, in turn, takes over management of the entire life cycle. Chemical Leasing can be used whenever chemicals are needed to provide a particular function or service. Examples include industrial cleaning and degreasing of parts in the metal processing industry; bonding of boxes in the packaging industry; cleaning of bottles, pipes and vessels in the beverage industry; lubrication of conveyor belts in the beverage industry; application of agrochemicals; corrosion and surface protection in the automotive and electric appliances industry; and cleaning in the hospitality sector (Joas, Abraham and Joas 2018). At the global level, the UNIDO Global Chemical Leasing Programme has promoted this business

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model since 2004 (UNIDO 2019). The economic advantages of Chemical Leasing have been analysed. A recent study (OECD 2017) reported that the benefits of increasing the **user's competitiveness** include: direct cost savings (reduction of chemical quantities if processes are further optimised); indirect cost savings (through energy and waste management); access to better knowledge, with improvement of processes and reduction of risks; reliable, long-term business relationships. In addition, the benefits of increasing the **supplier's competitiveness** include: higher profits (monetary reward for supply of expertise and services); reduced raw materials costs; reliable, long-term business relationships; access to knowledge about the application of chemicals; first-hand experience concerning areas for improvement/innovation of substances. Research shows that Chemical Leasing has improved the economic and environmental performance of companies across the chemicals supply chain and provided access to new markets (Moser and Jakl 2014; Joas, Abraham and Joas 2018). Nevertheless, the uptake of Chemical Leasing has not been as rapid as it could be. More work is needed to understand and overcome the obstacles which hinder the uptake of this approach.

Coordination benefit models: eco-industrial parks and chemical parks

Coordination benefit models are business models based on the coordination of nearby agents, where better economic and environmental benefits can be obtained than if there were no coordination. In the context of coordination between companies located near one another, a coordination benefit model can be referred to as "industrial symbiosis" (Bilsen *et al.* 2013). From a chemicals management perspective, both eco-industrial and chemical parks are of interest. While eco-industrial parks may host a wide range of companies, including chemical companies, chemical parks specifically host chemical companies.

Eco-industrial parks

A chemical park is a business model that brings together raw material suppliers, chemical manufacturers, producers of specialty chemicals, service providers and other companies at one site (American Institute of Chemical Engineers 2011). It can be defined as a "chemical manufacturing complex which possesses controlled entrance and exit points and accommodates several separately owned chemical manufacturing companies" (Dambmann and Allford 2003). These sites, managed professionally, provide a range of services, allowing investors and businesses to concentrate on their core fields. The concept, which originated in the 1990s in Germany, has expanded to other regions and countries, particularly China. The main drivers of chemical parks in China are restructuring and improvement of technological standards in the country's chemical industry, and the promotion of regional economic development through making investment more attractive to foreign and domestic investors. Chemical parks can have numerous benefits for tenants from both economic and environmental perspectives. A study carried out at the Rizhao Economic and Technology Development Kalundborg Park in Denmark, a pioneering site for chemical an industrial park, was developed because there was a need for rational consumption of steam by the Statoil refinery. In exchange for steam, the refinery sends its effluent cooling water to a coal-fired power plant as boiler feed (Planète Énergies 2016). Chemical companies may be part of eco-industrial parks (EIPs) in which businesses cooperate with each other and with the local community to reduce waste and pollution and efficiently share resources (e.g. information, materials, water, energy, infrastructure and natural resources). They may be planned from scratch or evolved over time. Companies in the region collaborate in using each other's by-products and otherwise share resources (Chertow and Park 2016). While the EIP concept mainly originated in Northern Europe, an increasing focus by international development organisations has led to the scaling up of these parks in developing countries (Kechichian and Jeong 2016). Evidence of the economic benefits of eco-industrial parks is well-documented. Firms in Ulsan Mipo and Onsan, part of the Republic of Korea's Eco-Industrial Park Initiative, have invested US dollars 520 million in energy efficiency, industrial symbiosis, waste management and other environmentally friendly improvements. The initiative is part of the country's Eco-Industrial Park Program, led by the Korea Industrial Complex Corporation (KICOX), which has resulted in 56 new patents, savings of 6.48 million tonnes of CO2 equivalent, and collective financial

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benefits of US dollars 1,680 million (World Business Council for Sustainable Development [WBCSD] 2018).

Customer-centric business models

A customer-centric model is built around a deep understanding of customers, what they value, and the contribution each makes to a company's profitability. This includes delivering a positive and seamless customer experience at every touch point across the customer life cycle, maintaining active dialogue with customers, and fostering a culture that puts the customer at the heart of the decision-making process (EY 2013). It may also involve more direct marketing and sales operations to reach consumers faster and more efficiently.

Additive manufacturing/3-D printing

3-D printing, also known as additive manufacturing, is a consumer-centric business model with the potential to revolutionise production processes. It has important implications for the chemical industry. An additively manufactured product is printed layer by layer, with each cross section stacked on top of the one below it. This is done without using large, high-throughput machinery, and at hundreds or thousands of remote locations, with near-zero waste (Phansey 2014). By "democratising" manufacturing, 3-D printing allows small fabrication businesses to reduce labour costs and offer manufacturing services close to the point of need. Service-oriented businesses are evolving which offer libraries and exchanges for 3-D printable digital blueprints; services to transmit these blueprints; and services for networking of 3-D printers (Duffy 2016). 3-D printing avoids the need to invest in producing moulds, which requires large product orders to achieve scale. This is of special significance for small and medium-sized manufacturing firms (Wayne 2017). Apart from providing more customer-centric solutions, 3-D printing provides significant economic and environmental benefits. It is estimated that it will reduce costs by US dollars 170-593 billion, primary energy supply by 2.54-9.30 exajoules, and CO_2 emissions by 130.5-525.5 megatonnes by 2025 (Gebler, Schoot Uiterkamp and Visser 2014). 3-D printing technology has significant potential for developing countries, as the cost of printers is falling below US dollars 500 (Ibrahim *et al.* 2015). 3-D printing has the potential to contribute to economic empowerment and improve the livelihood of communities in developing countries by providing opportunities to design and create tools that support and improve people's daily lives (Ishengoma and Mtaho 2014). 3-D printing, as a consumer-centric business model, provides significant opportunities for the chemical industry through, for example, developing innovative feedstocks, printing lab equipment, and maintaining plant assets (Guertzgen 2017). It also provides opportunities to use waste materials such as plastics as raw material for 3-D printing (Walker 2017). 3-D printing can improve efficiency and reduce the time required to manufacture individual batches. For example, a maker of invisible braces has used 3-D printing to increase batch size and reduce the time required to run each batch. The company also requires less space compared with its traditional manufacturing method (Pullen 2014). In addition, plastic waste can be turned into 3-D printing filament, so that 3-D printing becomes a viable means of consuming waste plastics (Kreiger *et al.* 2014; Mohammed *et al.* 2017). Researchers have designed a 3-D printer to synthesise pharmaceuticals and other chemicals from simple, widely available starting compounds fed into a series of water bottle-sized reactors. This technology could one day enable consumers to 3-D print their own drugs (Service 2018). The technology also enables the manufacture of medications that rapidly disintegrate with a sip of liquid even at high doses, which could help people who have difficulty swallowing pills (Crawford 2015).

E-commerce: selling chemicals online

Chemical distribution is evolving rapidly, with a growing number of companies and distributers selling chemicals online. In addition, e-commerce is a new way for small and medium-sized chemical distributors to reach existing and potential customers (Independent Chemical Information Service [ICIS] News 2016). Amazon Business, for example, is a business-to-business (B2B) platform that allows registered businesses to shop for office, janitorial and industrial goods online and obtain volume discounts. BASF later announced it would establish a flagship online store, along with other major chemical companies such as Covestro, on Alibaba's B2B platform, 1688.com (ICIS Chemical

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Business 2018). Specialty chemical companies have launched their online stores on the same platform to provide an easily accessible procurement process (Evonik 2017; Solvay 2018).

Social entrepreneurship business models

Social enterprises lie at a point of convergence between the nonprofit and for-profit spheres, combining the social orientation and objectives of NGOs with the market-driven practices of businesses. A social enterprise does not do social good to improve its image or regard this as a means to increase sales. Rather, it pursues social objectives and uses business approaches to attain these objectives (Panum and Hansen 2014). A social enterprise business model is essentially driven by a social mission, generates positive externalities for society, and recognises the centrality of the entrepreneurial business function (Bocken et al.2014).Social enterprises create economic value as a tool to achieve social goals (Perrini and Vurro 2006). Profit is seen as a tool for advancing sustainability. In this way, enterprises move away from grant dependency to become selfsufficient through the creation of income streams (Panum and Hansen 2014). Social enterprises address a range of social issues. These include social and environmental issues with direct or indirect links to chemicals and waste management. The Social Enterprise Mark is an example of an international social enterprise accreditation scheme that enables social enterprises to demonstrate they are making a difference. It independently guarantees that a business's central aim is to use its income and profits to maximise positive social and/or environmental impacts, and that this takes precedence over maximising personal profits for owners and shareholders (Social Enterprise Mark CIC 2018). Social enterprises have the potential to support and build on government initiatives (Ding 2017). They may also fill gaps when governmental action is lacking. They can have significant impacts in countries with low levels of state capacity to address social problems. From a government perspective, collaborating with social enterprises can result in short- and long-term gains for public budgets through reduced public expenditure and increased tax revenue (OECD and EC 2013). If such benefits are identified, enabling government institutions, resources and policies may be used to scale up social enterprises, including through partnerships with local governments (Shockley and Frank 2011). Social enterprises that address chemicals and waste management issues, directly or indirectly, are emerging in many countries. For example:

- A Melbourne, Australia, social enterprise called **Green Collect** gathers hard-to-recycle waste and employs socially disadvantaged people to refashion it into useful items to sell back to the companies that threw it out (Smith 2016).
- **Wecyclers**, a waste management social enterprise in Lagos, Nigeria, encourages households to collect and turn in waste. They receive "Wecyclers points" that can be used to buy household goods and services. Wecyclers sorts and aggregates the collected materials and sells them to local recycling processors (Okeugo 2015).
- **TackleTox** is a social enterprise that displays, on a map, information about toxic chemical substances emitted by corporations. It currently provides toxic scores for over 28,000 facilities in both the Republic of Korea and the United States (Yoon 2018).
- **Fairphone** is a social enterprise that aims to make smartphones in a modular way, so they can be easily repaired and upgraded over a longer period of use. It also avoids using minerals mined in conditions of armed conflict and human rights abuses (Keizer et al. 2016). Fairphone works with its partners to set up projects in Ghana to improve local waste collection efforts and transport discarded phones to Europe for safe recycling. Fairphone's Take Back Program helps ensure that old mobile phones are reused or properly recycled (Fairphone 2016).
- **Code Enterprise LLP** is India's first cigarette waste management and recycling firm. It operates in 20 states and has already recycled 4 tonnes of cigarette butts into useful products. A chemical process is used to recycle discarded cigarette butts into clean cellulose acetate, the polymer used in the butts. By-products can also be used for plantations and nurseries. The recycled polymer material is used to make cushions, garlands, small stuffed toys, accessories and key chains (Roy 2018).

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Governments in a number of countries use policy tools such as fiscal incentives, grants, awareness campaigns and incubation to encourage social enterprises (Sanchez 2016). SITR encourages individuals to support social enterprises and receive a tax deduction equal to 30 per cent of their investment (Government of the United Kingdom 2016).

Potential measures to advance the sustainability of business models

New and evolving business models, such as service-oriented models (Chemical Leasing) and models for benefit coordination (e.g. chemical parks), as well as social enterprises, can create opportunities to advance the chemicals and waste management agenda. Other models (e.g. 3-D printing and e-commerce) are also evolving rapidly and will benefit from careful scrutiny. Taking into account the preceding analysis, stakeholders may wish to consider the following measures to advance the sustainability of business models:

- Promote service-oriented chemicals management approaches, such as Chemical Leasing, to enhance resource efficiency and decrease use of hazardous chemicals;
- Use chemical parks as a model for sharing services, learning and information among companies, including SMEs;
- Explore the role and stimulate the establishment of social enterprises to support the sound management of chemicals and waste at all levels;
- Review the chemistry dimension of 3-D printing/additive manufacturing and take measures to reap its full potential by managing potential risk early on;
- Take measures to ensure that the distribution of chemicals through e-commerce meets high standards of chemical hazard communication, and is fully compliant with relevant legislation.

Experience with using market-based instruments in key industry sectors

Taxing pesticides to reduce environmental and health risks

Several countries, including Denmark, France, Norway and Mexico, have begun to use differentiated taxation of pesticides (mainly plant protection products) to incentivise farmers to reduce the use of hazardous pesticides. Factors taken into account in determining the taxes include, for example, hazard properties, health risks, environmental load or environmental harm, depending on the country. Recent evaluations have found evidence that taxation which is linked to hazards and risks can be effective in reducing pesticides' environmental and health effects. In contrast, non-differentiated taxation of pesticides (e.g. through ad valorem or per unit taxes) can have unintended consequences, as quantity reductions may be achieved through substitution with more toxic products (Finger *et al.* 2017). Closer proportionality of taxes to reduce environment and health risks may also increase the chance that a tax is perceived as fair. Such taxation may not only enhance the economic desirability of taxes, but also increase their political legitimacy (Söderholm and Christiernsson 2008).

Market-based instruments can be used at different stages in the chemical life cycle

Market-based instruments are applied at different stages of the chemical life cycle. The Norwegian tax on trichloroethylene and perchloroethylene from 2000 is an example of chemicals used in the metal manufacturing industry and dry-cleaning facilities being targeted (Slunge and Sterner 2001). Taxes on phthalates, polyvinyl chloride (PVC) and flame retardants introduced in Denmark and Sweden are examples of taxes targeting consumer products where it is the importer or product seller who pays the tax Taxes and/ or fees on plastic bags used in Ireland, South Africa, the United Kingdom, the United States and a number of other countries are examples of those paid by consumers.

Charges and refunds used to finance hazardous waste management

Charges and deposit refund systems are frequently applied in the management of hazardous wastes such as batteries, end-of-life vehicles, and waste electric and electronic equipment. These instruments can both incentivise reduced use of, for example, batteries containing hazardous chemicals, and finance systems for the collection and processing of hazardous waste. In many countries the establishment of extended producer responsibility (EPR) systems has shifted the cost of waste management from authorities to producers and greatly increased the rate of recycling of different waste categories. A provincial EPR programme for tyres across Canada, for example,

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increased the rate of collection to ~90 per cent, and largely eliminated the stockpiling and burning of end-of-life tyres countrywide (Canadian Association of Tire Recycling Agencies 2018). However, little effect has been seen on product design. Costs to producers are often not directly connected with their own products, while insufficient collection further lowers the incentive for eco-design (Kalimo et al. 2015; Turner and Nugent 2016; Zeng et al. 2017).

Considering circularity in supply chain management

In the corresponding EU Action Plan for the Circular Economy, it is stressed that the functioning of value chains needs to be rethought. Value chains, especially for complex composite materials (e.g. plastics) or chemical formulations (e.g. plant protection products), are closely connected with the creation of material cycles, where hazardous chemicals are reduced to a minimum in support of a “non-toxic environment” (Goldenman et al. 2017). The new database to be hosted by the ECHA, created under the amended Waste Framework Directive on the presence of substances of very high concern (SVHC) in articles, is a concrete measure to help achieve this goal (ECHA 2018).

Resource efficiency considerations include transitioning from a traditional linear flow of materials in a “take-make-use-dispose” economy to a more circular flow of materials. In this approach a core principle is the elimination of waste through improved design of products, use of processes that have increased resource efficiency, and increased recyclability of materials (Sheldon 2016). Circular supply chains therefore cover remanufacturing, reuse and recycling processes (Dora, Bhatia and Gallear 2016; Genovese et al. 2017). Maintaining the value of materials, products and resources in the economy for as long as possible, and minimising waste generation, represent an essential contribution to the development of sustainable, low-carbon, resource-efficient and competitive economies (EC 2015). End-of-life treatment of chemicals and products is the stage at which improved waste management and recycling strategies are considered. Chemical contamination of articles may prevent recycling, or it may present new, unexpected exposure situations if contaminated recycled materials are used in products when use of these substances was not foreseen (Goldenman et al. 2017). Promotion of uncontaminated material cycles and better tracking of chemicals of concern in products can help address these concerns and facilitate recycling through the uptake of secondary, non-toxic raw materials. Improved tracking of chemicals of concern should also be used to identify contaminated materials in the waste stream and separate them, in order to maintain a high recycling rate while generating uncontaminated secondary raw materials.

Integrating life cycle thinking and sustainability into product design

Taking a systems approach in designing products

To address challenges associated with chemicals and their products, it may not be sufficient to base chemical synthesis on functionality criteria only (e.g. water repellency, resistance to high temperatures and economic viability). Sustainable design and supply chain solutions go a step further, considering life cycle impacts, from synthesis (energy, water, other chemical use) to toxicity and environmental effects, during the product life cycle as components of chemical and product design criteria. Chemical and product design, synthesis and manufacturing are therefore important stages for the implementation of broader sustainable supply management strategies, which can be understood as a systemic shift involving both technological and non-technological innovations (Kirchherr, Reike and Hekkert 2017; Homrich et al. 2018).

Use of safety data sheets

Many SMEs in developing countries routinely use and handle chemicals. When they do so, attention needs to be paid to accompanying labels and safety data sheets (SDS). Often, however, developing country SMEs carry out their activities without having proper on-site list of hazardous substances, accompanied by corresponding SDS. Moreover, employees receive only limited training and re-training to help them understand and apply the information found on labels and SDS (Massey 2008). To be effective, communication of risks to employees needs to be simple and practical, taking into account the context and their level of education.

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Occupational health and safety

Many work environments in developing country SMEs are dangerous. Not only do a large share of occupational accidents in these countries occur in SMEs (Nyirendaavwil, Chinniah and Agard 2015), but chemical accidents in SMEs are seriously under-reported because of poor data and analysis capabilities. Risks therefore need to be systematically assessed, analysed and, where necessary, reduced to improve safety at work (Nordlöf et al. 2017). The adoption of a functional occupational health and safety management system (OHSMS) by an SME is an important measure that can lead to fewer occupational accidents. Regularly measuring and keeping track of a company's safety culture, and openly discussing occupational health and safety (OHS) values, are priorities in this context. Factors such as the company's size, its safety culture, the extent of high-level company commitment, lack of relevant skills, lack of technical know-how, lack of formalised routines, and financial affordability need to be understood and addressed (Nordlöf et al. 2017).

Sustainability assessment tools for chemicals

To address the entire chemical or product life cycles in a wider sustainability context, several types of tools and methods exist that build on life cycle thinking. They range from political instruments, international agreements and international standards to procedural and analytical tools. Political instruments include regulations on supply chain and waste/end-of-life management or on integrated environmental management interventions. An example is the EU's Integrated Pollution Prevention and Control Directive 2010/75/EU (EC 2010). International standards refer mainly to the (ISO) 14000 family of environmental management standards (ISO 2018). Several of these standards are directly concerned with procedural and analytical life cycle management (LCM) tools. LCM encourages a holistic management perspective. It covers the entire chemical or product life cycle and calls for managerial decisions that consider health and environmental impacts. LCM provides an opportunity to promote long-term achievements in order to minimise the environmental and socio-economic burden while maximising economic and social value (Bey 2018). Applying a life cycle perspective is even more relevant in regard to advancing a circular economy, closing material loops along entire chemical and product life cycles and creating self-sustaining production systems. More specific procedural tools include, among others, eco-design (defined in ISO 14006), environmental labels and declarations (defined in the ISO 14020-14025 series) and environmental performance evaluation (defined in ISO 14030 and 14031). The most relevant analytical tool with a focus on the entire life cycle of chemicals and products is life cycle assessment (LCA), which is defined in the ISO 14040-14049 series (ISO 2018). The use of LCA to evaluate the environmental performance of products, services and technologies across sectors and countries has received increasing attention in the last two decades. LCA consists of four phases: goal and scope definition; life cycle inventory (LCI) analysis; life cycle impact assessment (LCIA); and interpretation. The LCI determines resources use, and chemical or pollutant emissions, based on a common product function. The LCIA phase focuses on characterising the impacts of these LCI flows in several impact categories, such as global warming, human toxicity, ecotoxicity and water use. These impact categories cover three major areas of protection: human health; ecosystem quality; and natural resources (Verones et al. 2017).

Assessing chemicals' impacts in a life cycle-based comparative framework

When focusing on chemicals, it is important to assess their risks consistently with other types of impacts on human health and the environment. Several approaches, such as USEtox (Henderson et al. 2011; Rosenbaum et al. 2011), have been developed at the interface between risk assessment and LCA to adapt exposure and dose-response information for use within a comparative life cycle-based framework (Fantke et al. 2016). Key elements include:

- quantifying during the product life cycle – to the extent possible – the chemical use and the mass emitted to the far-field environment within the supply chain, or the chemical mass that enters a defined compartment of entry in the consumer's near-field environment;
- capturing fate and exposure processes that result in transfers of chemicals between any near-field compartments (e.g. indoor air, the inside of objects) and far-field compartments (e.g. freshwater, ambient air) until finally reaching biota or humans;

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- combining human intake via all relevant exposure pathways with dose-response, severity or other hazard information to assess risk or impact levels; and
- combining environmental concentrations with concentration-response information to assess related fractions of species that have disappeared or are affected due to chemical exposure in different environmental compartments (Verones et al. 2017).

3. Legal assessment of the legislation regarding waste management in the BG-RS CBC region

3.1. Waste management legislation in Serbia

Environmental Protection Law

The first systemic law that regulated the basic environmental protection issues in an all-encompassing way was the 1991 Environmental Protection Act. This law set the foundation for the passing of subsequent acts, becoming the tipping point in a more serious approach to regulating this area of state legislation. The Law on Environmental Protection (*Official Gazette of RS*, no.135/2004) represented a new legal framework in the area of environmental protection that has been completed with the adoption of the Law on Waste Management (*Official Gazette of RS*, no. 36/2009), as well as 16 additional acts. The Law on Environmental Protection prescribes that import of hazardous waste shall be prohibited. A permit for import, export and transit of waste shall be issued by the Ministry of Environment and Spatial Planning in compliance with the Law and other regulations. Serbia ratified (and is a party to) the Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal. There had been no significant changes until early 2016, when there was an all-encompassing reform of these acts for the purpose of adapting legislation to the European standards. The European Commission pointed out the lack of regulation in the area of ecology and environmental protection as a major drawback in Serbia's EU accession process. Environmental protection is performed through the application of the *polluter pays* and the *user pays* principles, as well as the *subsidiary responsibility principle*. (*Official Gazette of RS*, no.14/2016, article 21)

National Waste Management Strategy

The 2003 National Waste Management Strategy for the period 2003-2008 was evaluated in the process of preparation of the 2010 National Waste Management Strategy for the period 2010-2019. This evaluation shows that achieved results are behind targets set in the 2003 Strategy. Most of the planned measures were not implemented, implemented only locally as a result of municipal initiative, or delayed for several years. The National Waste Management Strategy for the period 2010-2019 aims to achieve compliance with EU waste management targets. The Strategy's objectives are both short term (2010-2013) and long term (2015-2019). The National Waste Management Strategy for the period 2010-2019 defines individual targets and objectives but lacks information on how to achieve them. Economic instruments aimed at stimulating waste generators to change their practices towards planned objectives are also lacking in the Strategy.

Administration

Competences in the field of waste management are divided between the national and municipal levels. The main responsibility for waste management resides in the Ministry of Environment and Spatial Planning. The main feature of waste management legislation is that it does not cover all aspects of waste management within existing provisions of legal acts (law and regulations). The Division for Waste Management is part of the Department for Planning and Management on Environment in the organisational structure of the Ministry of Agriculture and Environmental Protection. The Division for Waste Management is responsible for preparation of the national strategy and NWMP and plans for special waste streams. It also prepares executive regulations and technical standards for implementation of waste management law. The Ministry approves regional waste management plans except for plans on the territory of the Autonomous Province, issues permits, approvals and confirmations of national importance, and maintains records of them as well as other permits issued by regional and local bodies. Each local self-government unit (municipality) is responsible for preparation of a local waste management plan, and creating conditions and support for

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its implementation. The municipality is responsible for provision of municipal and nonhazardous waste services and for setting fees for these services. It also issues permits, approvals and other documents as defined by the Law on Waste Management for waste activities on its territory, maintains permit records, and submits data on waste to the Ministry.

Law on Waste Management

Some waste management issues are regulated, such as environmental impact assessment, emission limits, quality standards, management of waste, disposal sites, classification, packing and care of secondary raw materials, communal activities and concessions, but existing legislation is not yet in compliance with EU legislation, and it has not been fully implemented. As a part of the set of environmental laws came the changes to the Law on Waste Management, by passing the Law on Amendments and Additions to the Law on Waste Management (*Official Gazette of RS*, no.14/2016). Since the Law on Waste Management was passed in 2009, this has been the first major change of the law since 2010. It sets: forth types of waste and its classification; waste management planning,; stakeholders; obligations and liability with regard to waste management; specific waste streams management; requirements and procedures for the issuance of permits transboundary waste movement; waste management financing; supervision and other relevant aspects of waste management. The rights and duties of environmental inspectors, defined in the Law on Waste Management, are broad and give a strong mandate to the inspector to enforce the Law. The inspector has, for example, the right to order waste generators to hand waste over to a person authorised for waste disposal/treatment, order closure or remediation of a disposal site, prohibit disposal or treatment of waste or order a generator to start separate collection of waste. The Law on Waste Management is supported by a number of by-laws, which provide details on waste categorisation and record-keeping, incineration of waste, transboundary movement of waste and waste disposal. Several by-laws regulate special waste streams (annex IV). The Law on Amendments and Additions to the Law on Waste Management has several important objectives:

- Precisely defining the terms such as *waste*, *waste management facility*, *waste decontamination*, *landfill*, *waste preparation and reuse*, *waste creator*, *secondary raw materials*, waste management and treatment are defined in a different manner, and other (*Official Gazette of RS*, no.14/2016, article 2).
- Waste reuse and further use.
- A further development of the system of reporting and the register in the area of waste management.

Waste Framework Directive (2008/98/EC)

The above mentioned additions to the Law that deal with the end-of-waste criteria are in complete accord with the EU Waste Framework Directive (2008/98/EC). Treating by-products as secondary raw materials is of the uttermost importance for the recycling industry, thus, metals, non-ferrous metals, plastic, glass and paper no longer have the waste status, whereas the manufacturing byproducts are no longer considered as industrial waste. In this manner, Serbia will reap the benefits and material gain from using this waste instead of its disposal, which used to be the case. The system for reporting on waste management that has been established by the adoption of this Law became additionally perfected following these additions. The changes have been focused towards the increase in frequency of reports on waste movement and its recycling, as well as the application of modern informational technologies, while creating online registers and databases on waste that are currently accessible over the Internet at any period of time using the computer.The information system of waste management in Serbia is regulated by the Rulebook on Daily Records and Annual Reports of Waste Containing Instruction for its Completion (*Official Gazette of RS*, no. 95/2010, no. 88/2015), in which are defined both the basic methods and the means of reporting, not only on a daily basis, but also on an annual basis. The core of reporting is represented by the documents whose aggregation on a daily basis results in the daily records on waste, whereas the aggregation of daily records results in the annual report on waste. The Rulebook was adopted as early as 2010, when it was passed along with other bylaws, in the period following the adoption of the Law on Waste Management. Waste

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management in Serbia started a new era when the country developed a legislative framework based on EU waste management policy. There is a trend towards regionalisation of waste management services, which is providing opportunities for private sector involvement. However, development of the necessary infrastructure lags behind expectations, mainly due to insufficient sources of local financing and dependence on funding by foreign donors.

Waste management

Waste management consists of a set of activities of joint interest which comprise implementation of prescribed action plans to be carried out within waste collection, transport, storing, treatment and disposal, including supervision of the aforesaid activities and responsibility for waste management facilities upon closure thereof. Strategy of Cleaner Production Introduction (Official Gazette of RS, no 17/09) was adopted by the Government in March 2009, and it is the elaboration of strategic documents, especially of the National Sustainable Development Strategy and National Environmental Protection Programme. The Decision on the Establishment of the National Environmental Protection Programme (Official Gazette of RS, no. 12/10) defines strategic objectives of the environmental protection policy, as well specific objectives for protection of environmental media (air, water, soil) and influence of certain sectors on environment (industry, energy, agriculture, mining, traffic, etc.)

Basic regulations which govern waste management in the Republic of Serbia are the following:

- Law on Ratification of the Basel Convention on Transboundary Movement of Hazardous Waste and its Disposal (Official Gazette of FRY, International Agreements, no. 2/99
- Law on Environmental Protection (Official Gazette of the Republic of Serbia, no. 135/04 and 36/09)
- Law on Strategic Environmental Impact Assessment (Official Gazette of RS, no. 135/04)
- Law on Environmental Impact Assessment (Official Gazette of the RS, no. 135/04 and 36/09)
- Law on Integrated Pollution Prevention and Control (Official Gazette of RS, no. 135/04)
- Law on Packaging and Packaging Waste Management (Official Gazette of RS, no. 36/09) sets forth environmental requirements which packaging must meet in order to be marketed; packaging and packaging waste management, reporting on packaging and packaging waste, economic instruments in the form of product charges, and recovery targets for paper, plastics, glass, metal and wood, as well as other relevant issues with regard to packaging and packaging waste management. The Law also regulates imported packaging, produced, i.e. marketed packaging, as well as packaging waste generated in the course of business activities on the territory of the Republic of Serbia, regardless of its origin or purpose, and used packaging material. The Decree on establishing a plan to reduce packaging waste for the period 2010-2014 (Official Journal RS 88/2009) defines the targets for recovery and recycling.

Radioactive waste

Regarding radioactive waste, the Serbian Radiation Protection and Nuclear Safety Agency is responsible for preparation of the Radiation Safety and Security Programme, the Nuclear Safety and Security Programme and Radioactive Waste Management Programme. The Agency issues licences for operation of radioactive waste storage, including conditions of operation, reporting requirements and terms of inspection. It also issues licences for radiation practices, which can include authorisation of temporary keeping of radioactive waste at the premises of the legal entity that produced the waste.The Rulebook on radioactive waste management (OG 60/11) prescribes the methods of temporary storage of radioactive waste at the place of its generation; conditions under which the radioactive waste is kept, collected, recorded, stored, processed and disposed; and keeping of records about radioactive waste and deadlines for delivering the records to the Serbian Radiation Protection and Nuclear Safety Agency. Radioactive waste is regulated by the Law on Ionising Radiation Protection and Nuclear Safety.

Management of other products (old vehicles, tyres, construction waste etc)

Rulebook on the manner and procedure of end-of-life vehicle management ("official gazette of the republic of Serbia", no. 98/2010). This Rulebook applies to vehicles and end-of-life vehicles,

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including built-in components and materials regardless of the manner in which the vehicle is serviced or repaired during its use and whether or not the vehicle is equipped with components that the manufacturer shipped or other components installed as spare parts.

Rulebook on manner and procedure of waste tyres management

Management of waste tyres is a set of measures that include collection, transportation, storage, and treatment of waste tyres. Management of waste tyres is conducted in such manner as to ensure the protection of human health and the environment. Waste tyres may not be disposed of in landfill. For 2010 the recycling of waste tyres shall comprise 70% and use for energy purposes 30% of the total quantity of waste tyres collected in the previous year. The recycling of newly-created waste tyres from this Rulebook's entry into force to 31 December 2010 shall comprise 70% and use for energy purposes 30% of the total quantity of waste tyres collected in the previous year.

Rulebook on manners and procedures of used batteries and accumulators management ("Official Gazette of the Republic of Serbia", No. 86/2010). This Rulebook shall set forth the content and appearance of labels on the batteries, button cell batteries and accumulators according to the content of hazardous material, manners and procedures for waste management of batteries and accumulators, as well as devices with built-in batteries and accumulators.

Collection of waste

The Ministry of Agriculture and Environmental Protection, regional and local authorities issue permits for collection, transport, temporary storage, treatment and disposal of waste (table 8.11). Permits for hazardous waste management are issued by the Ministry only, as are permits for activities which extend beyond the territory of a single municipality. Recycling of waste is meeting national targets but separate collection is introduced only as a local activity of individual municipalities. Serbia has developed and implemented a system of permitting of waste management activities and is improving its control over the transboundary movement of waste. The transboundary movement of waste is regulated in line with the Basel Convention. Basically, there are two types of documents on waste movement that are regulated by separate acts - the Rulebook on the Form of the Document on Waste Movement and the Instruction for its Completion (*Official Gazette of RS*, no.114/2013), as well as the Rulebook on the Form of the Document on Hazardous Waste Movement and the Instruction for its Completion (*Official Gazette of RS*, no.114/2013). Law on Transportation of Hazardous Substances *(149-152)* forbids the importation of hazardous waste from abroad that is intended to be disposed permanently or temporarily on Serbian territory. It is the duty of the legal depositor or the owner to ensure secure transport of dangerous substances. The hazardous waste transport contains another important characteristic, presented in the fact that the transport vehicles, as well as their drivers, need to have adequate ADR licenses, with an additional obligation of reporting the exact route of moving the hazardous material to the line Ministry. The Ministry of Agriculture and Environmental Protection issues permits for the export, import and transit of waste. The Law on Waste Management defines that prices for waste management services should be cost based. For development of waste management infrastructure, earmarked funds are considered as the main source of financing. These earmarked funds are revenues of the Environmental Protection Fund, funds in the Autonomous Province budget, funds of local self-government units, loans, donations and funds of legal and private entities which manage waste, charges and other sources of financing. Detailed requirements are set for the transport of hazardous waste, introducing the cradle-to-grave system. Special waste streams are regulated according to the producer's responsibility principle, setting specific requirements on import, collection and recovery of accumulators and batteries, oils, tyres, electronics and end-of-life vehicles. The group of special waste streams was extended to include those waste types on which the authorities are focused: fluorescent tubes, PCB-containing equipment, POPs, asbestos, titanium dioxide and packaging waste.

Waste fees

The only economic instrument in waste management used in Serbia is charging users for provided waste collection and disposal services. Waste fees are calculated per square metre of residential or business area. Typically, collection of waste fees is carried out by PUCs that deal with collection,

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transport and disposal of waste. Fees from households are collected on a monthly basis, whether through a system of joint fees for both waste and utility services (mostly for water consumption), or separately. In larger towns, the joint system of fee collection is used, while separate collection prevails in smaller towns. The Law on Waste Management introduced the principle of producer's responsibility for products which become special waste after use. This is connected with payment of a fee for placing a product on the market and the fee is used to cover the cost of recycling. Currently, this fee is levied on tyres from motor vehicles, products containing asbestos, batteries or accumulators, mineral and synthetic oils and lubricants, electrical and electronic equipment and passenger cars.

3.2. Waste management legislation in Bulgaria

The waste management policy and legislation in Bulgaria aims at implementing the relevant EU directives, regulations and decisions in the field. The total amount of municipal waste generated decreased from close to 5 million tons in 2000 to slightly more than 3 million tons in 2014. The amount of waste generated per capita decreased accordingly, from more than 600 to 442 kg/capita/year. The number of settlements and inhabitants served by collection services increased substantially. Nowadays, 99.6 per cent of the population is covered with waste services. The formal system of separate collection of packaging waste was introduced in Bulgaria in 2004. At that time, only slightly more than one third of the generated packaging waste was recycled, and by 2014 this proportion had reached 61.7 per cent.

National Waste Management Plan

The 1999 first NWMP for the period 1999-2002 set conditions for solving the pressing tasks related with the environmentally sound waste management. National programmes for specific waste streams were elaborated during the period 2002-2003, including for end-of-life vehicles, WEEE, used batteries and accumulators, and packaging waste. The subsequent national plans for management of waste-related activities are the second NWMP for the period 2003-2007, updated and expanded in 2008, and the third NWMP for the period 2009-2013, which set 10 strategic goals, including regarding the prevention and reduction of waste generation, increase in the quantities of treated and recovered waste, and environmentally friendly disposal of waste. The majority of the measures aimed at meeting the strategic goals are implemented, including the measures for the improvement of administrative capacity, introduction of economic instruments for stimulating recycling and prevention of the generation of waste. In 2009-2010, within the framework of the NWMP 2009-2013, the Ministry of Environment and Water developed two strategic documents on management of specific waste streams, in which, for the first time, the situation was analysed, the main challenges were identified and measures for their management were planned. The fourth NWMP for the period 2014-2020 aims at discontinuing the link between economic growth and waste by preventing the generation of waste and by setting specific quantitative targets for preparation of reuse, recycling and other forms of recovery for specific wastes. NWMP, 2014-2020 includes objectives on the transition from waste management to the efficient use of waste as a resource and sustainable development through waste prevention. The Plan supports the central and local authorities to concentrate resources from national and European funding sources on priority projects in the field of waste management. The Plan includes the following annual objectives for packaging waste:

- No less than 60% by weight of packaging waste to be recovered or for energy recovery;
- No less than 55% and not more than 80% by weight of the packaging waste must be recycled – recycling should be not less than: 60% by weight of glass packaging waste; 60% by weight of paper and cardboard packaging waste; 50% by weight of metal packaging waste; 22.5% by weight of plastic packaging waste – the recycling is only to obtain plastic; 15% the weight of the wood packaging waste; and

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- Systems for separate collection of packaging waste cover not less than 6 million inhabitants of the country and must include resort towns and all cities with a population over 5,000 inhabitants

For the first time, within the scope of development of the NWMP 2014-2020, a **National Waste Prevention Programme** has been developed. Specific measures aimed at improving hazardous waste management are foreseen in the NWMP 2014 2020:

- Increasing capacity of the competent authorities;
- Financial and technical support to individuals generating household waste and companies engaged in activities with household waste;
- Building sites for free delivery of separately collected household waste.

The Plan also envisages measures to improve the management hierarchy of other waste streams and to reduce the risk to the environment from landfills. Within the scope of the national system of programming documents, two further strategic documents formulate goals and determine measures relating to two specific fields of waste management. An increasing number of municipalities introduce separate collection facilities run by private operators; and many contractors carry out public awareness campaigns in the communities. The NWMP 2014-2020 [BG NWMP 2014] is the main strategy implementing separate collection in Bulgaria.

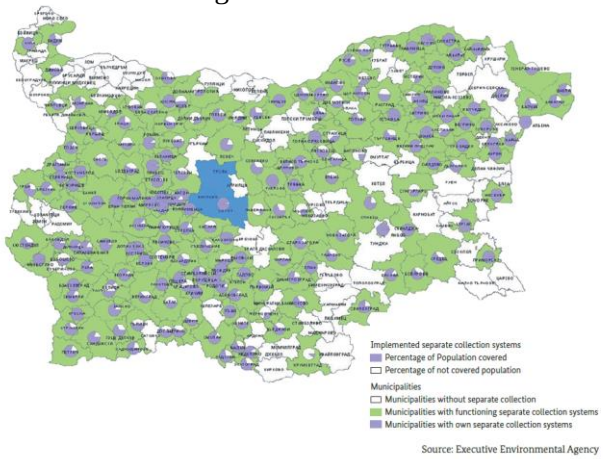

Figure 36. Distrbution of separate collection of packaging waste systems in Bulgaria in 2010

In Bulgaria, separate collection targets and systems have been established for widespread waste in accordance with the EU Waste Framework Directive, i.e. packaging waste (by 2020 recovery of 56% of generated packaging waste (PW), recycling of 54% generated PW), ELVs (by 2020 separate collection of 100%, recycling of min. 85%), WEEE (by 2020 separate collection and recycling of min 65% of the EEE released in the past 3 years), waste from batteries and accumulators (WBA) (by 2020 separate collection of 45%, recycling of min 45% of the batteries and accumulators released in the same year), waste oils (by 2020 recycling of min 45% of the oils released in the same year) and end-of-life tyres (by 2020 recovery of min 65% of tyres released in the previous year and recycling of min 50% of tyres released). Policy instruments applied to move up the waste hierarchy: Bulgaria has introduced intermediate targets up to 2013 for waste recycling and recovery (i.e. 33 %). Bulgaria’s private sector has started to engage in recycling. Six collection and recycling operators dominate the national market for recyclables. Recovery facilities are limited. However, no national data on recycling are available, and serious concerns prevail that the private sector will primarily target higher value recyclables which would not suffice to achieve the ambitious recycling targets.

Waste Management Act

Prior to the entering into force of the Reduction of the Harmful Impact of Waste upon the Environment Act in September 1997, there was no special legislation in that field in Bulgaria. The 1997 version of the Waste Management Act, for the first time, regulates public relations in the waste

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management sector and introduces a series of basic requirements of the WFD 75/442/EEC, including the obligations of persons; the carrying out of waste-related activities; information relating to waste-related activities; waste management programming through the national, municipal and company programmes; approval and control over waste-related activities; export, import and shipping; and fees and sanctions for non-compliance. It also provides, for the first time, definitions of "waste", "polluter" and "owner" of waste. This law introduces the extended producer responsibility principle through the requirement for producers and importers of products, which, during the process of their manufacturing or subsequent to their end use, generate hazardous or widespread waste, to pay product eco taxes. Several further regulations have been introduced as a means to detail the provisions of this law. The Waste Management Act, which entered into force in September 2003, further develops the philosophy of the 1997 law and fully transposes WFD 75/442/EEC; together with the ordinances to the law, it introduces the requirements of all European directives in the waste management sector. At the time of Bulgaria's accession as a member of the EU in 2007, the legislation in the sector was harmonised with European law. Amendments to the law from 2010 introduced economic stimuli for specific actions on behalf of local authorities to decrease the amount of landfilled waste as well as to transition towards the regional household waste management principle. The Waste Management Act, which entered into force in July 2012, introduces the requirements of WFD 2008/98/EC, including the polluter pays and extended producer responsibility principles and the hierarchy of waste management. For the first time, it introduces targeted operational goals for recycling of household and construction and demolition waste and requirements for the facilities and installations for waste management; if further introduces economic and regulatory mechanisms and instruments for application of the relevant legislation as well as rules for management of widespread waste. It settles the "end of waste" and "by-products" approaches and presents in detail the control functions of the institutions as well as the specific fines and sanctions for non-compliance with the law. Quantitative goals are established for preparing, reuse and recycling of waste materials, including at the very least paper and cardboard, metal, plastic and glass from household and similar waste from other sources, which the municipalities need to meet within 1 January 2020 - at least 50 per cent of their total weight. The Act introduces a requirement for municipalities to limit, by 2020, the quantity of landfilled biodegradable household waste by 35 per cent compared with the total quantity of those wastes generated in 1995, and to meet the goals for reuse, recycling and other forms of recovery of waste from construction and demolition of buildings, which is the responsibility of the contracting authorities for construction works, be they a public institutions or a business. The Act determines the national competent authorities within the framework of Regulation (EC) No 1013/2006, and the requirements for financial guarantees for cross-border shipment, as well as the feasible exceptions. The shipment to Bulgaria of waste, designated for incineration or co-incineration with energy recovery, is forbidden for each installation if the total quantities for the respective calendar year exceed half of the annual capacity of the installation. In cases when the National Plan for Waste Management formulates specific measures for the management of a given type of waste or a given stream of waste, the Council of Ministers may limit the import of these wastes. Since mid-2014, the Waste Management Act brings a new obligation to the authorities for approval of a plan for management of construction and demolition waste. All authorities that procure public works contracts financed by public funds are required to include in the tender documents a requirement for use of recycled construction materials. According to the Waste Management Act, for operations relating to the disposal of waste by landfilling, each landfill owner shall provide collateral covering the future expenses for closure and aftercare for the landfill site. The collateral is due for disposal of waste on landfills for non-hazardous waste, as well as for disposal of hazardous waste on landfills for hazardous waste.

The National Strategy for Waste Management of Construction and Demolition for the period 2011 2020 is also the first to be elaborated in the country for this field. The 2014 Plan for Management of Construction and Demolition Waste determines measures (administrative, legal, financial and others) for increasing the recycled and recovered quantities of this waste stream, which is mainly subject to disposal. The main strategic goal of the Plan is to decrease, by 2020, the negative

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impact of construction and demolition on the environment and to reach 70 per cent recycling of construction and demolition waste. Installations for recycling of construction materials are in the process of operationalisation as part of the integrated regional municipal systems for waste management. The Ordinance on construction and demolition waste management and use of recycled building materials brought into force in 2012 defines more specific regulations regarding the objectives of collection and reuse of waste and the obligations of parties, and aims to: prevent and minimise the generation of construction and demolition waste; encourage recycling and recovery of this type of waste to reach targets in the Waste Management Act; increase the use of recycled building materials; reduce the quantities of landfilled construction and demolition waste. Before starting construction works and/or removal of buildings, the contracting authority shall prepare a Plan for management of construction and demolition waste. The contracting authority is responsible for the management of the construction/demolition project, whether carried out by itself or assigned for fulfillment of the obligations related to waste management to a contractor by means of a written contract. The requirements for preparation of a Plan for management of construction and demolition waste has been in force since 2014. With regard to the requirements of WFD 2008/98/EC, the systems for treatment of construction and demolition waste should ensure, no later than 1 January 2020, its reuse, recycling and other recovery of materials from non-hazardous construction and demolition waste, including backfilling operations, by replacing other materials in a quantity not less than 70 per cent of the total weight of waste, excluding unpolluted soil, excavated land and rock in their natural state. The 2005 Ordinance for the treatment of waste from vehicles regulates in practice the use of producer responsibility by requiring producers and importers to participate in the process of treatment of waste vehicles. It allows manufacturers and importers of vehicles to fulfil their obligations individually or through a collective system. Individual performance can be achieved in two ways, either by organising all activities of the obligated person or by paying a product fee to EMEPA.

The 2005 Ordinance on requirements for treatment and transportation of waste oil and petroleum products defines the requirements for the marketing of oils and for separate collection, storage, transport, recovery and disposal of waste oils and oil products to regulate: prevention and reduction of environmental pollution and risk to human health and the environment as a result of treatment and transportation of waste oils and oil products; the taking of measures by the persons placing oil products on the market for the separate collection, recovery and/or disposal of generated waste; implementation and operation of an environmentally friendly system for management and control of the activities of transporting and treating waste oils; informing end users about their role in the separate collection of waste oils and petroleum products and collection, recovery or disposal systems available; measures that determine extended responsibility for manufacturers. The Ordinance regulates the hierarchy in the treatment of waste oils. The priority is the recovery of waste oils through regeneration. In cases where technical and economic conditions do not allow regeneration, waste oils are incinerated with energy recovery. If it is impossible to apply any of the above methods, used oils are stored and subsequently delivered for disposal. The 2011 Ordinance on requirements for treatment of used tires applies to all types of tires placed on the market (external, internal and thick), regardless of their purpose. Legal persons who place tires on the Bulgarian market are responsible for the collection, storage, transport, recovery or disposal of used tires. They have to meet the following objectives: not less than 65 per cent of the amount (in tons) of tires placed on the market in the current year to be recovered; not less than 50 per cent of the amount (in tons) of tires placed on the market in the current year to be regenerated and/or recycled. The 2011 Spatial Planning Act requires that municipalities ensure the availability of the terrains and the construction of facilities and installations for treatment of household and construction and demolition waste. This text formulates considerable requirements for the municipalities in comparison with the necessary competences stemming from the provisions of the Waste Management Act. With regard to construction and demolition waste on the territory of a municipality, the duties of the municipality used to boil down to organisation of the collection, recovery and disposal of construction and demolition waste, solely from repair activities, generated by the households on the territory of the respective municipality, as well as the general

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requirements that are valid for all contracting authorities of investment projects. The Statistics Act regulates matters relating to the confidentiality of information and the conditions for provision of information from all economic stakeholders, including municipalities. Since the provision of these services on household waste are typical public services, paid for with public finances of the municipalities, accumulated from consumer taxes for these services, only the aggregated information, provided by the municipalities, is freely accessible to the public and the institutions. The National Strategic Plan for the Stage-by-Stage Reduction of Biodegradable Waste for Disposal 2010-2020 is the first plan in the country to conduct an in-depth systematic analysis of the environmental problems resulting from disposal of biodegradable waste. It defines the problems and identifies measures (administrative, legal, financial and others) for overcoming the problems and for meeting the goals for stage-by-stage reduction of the disposal of these wastes and for increasing amounts of recycled and recovered waste. It is anticipated that, as a result of the implementation of the Plan, the disposal of five million tons of biodegradable waste will be prevented by 2020. An additional effect is the substitution in agriculture of phosphate fertilisers with compost. The measures in the Plan are key for the achievement of the goals of the third NAP for Climate Change for the period 2013-2020 to reduce GHG emissions from the waste sector. The Ordinance on the separate collection of bio-waste and treatment of biodegradable waste is important for encouraging investments in modern, innovative facilities, systems and business models for using waste as a resource to support the circular economy. The Regulation lays down obligations for municipalities to implement systems for the separate collection and recycling of bio-waste (food and green waste as part of the household waste stream). A new Ordinance on separate collection and treatment of biowaste was adopted in early 2017. The new Ordinance stipulates that the amount of landfilled biowaste must not exceed 109kg per capita by 2020. Progress in accordance with that target has yet to be measured. The landfill tax is set to rise progressively to EUR 48.6 per tonne by 2020. There is an incentive scheme for municipalities linked to this tax. Those municipalities that meet their recycling target will not have to pay landfill tax. This should stimulate the market if the measure is enforced. In 2016, several calls to use cohesion policy funds were published, targeting green and other biodegradable waste collection and treatment. The Operational Programme makes funding available to municipalities for biowaste treatment. Bulgaria continues to set up legislation and set more ambitious recycling targets for the period up to 2035. These targets will be taken into consideration to assess progress in future Environmental Implementation Reports. The National Plan for the Management of Sewage Sludge from Municipal Wastewater Treatment 2013 2020 is the product of cooperation between the German Federal Environment Agency and Bulgaria's Ministry of Environment and Water. Produced along with the Plan were a Technical Guide on the most recent technologies for sewage sludge management, and guidance to assist the operators of wastewater treatment facilities to develop their own concepts for sludge management in the context of local conditions, individual circumstances and potential. A new National Ordinance on sewage sludge, last amended in 2011, has been the first legislative act to result from the Plan. As of 14 July 2014, the Ordinance on the construction of buildings and roads using public funds mandates the need to integrate recycled construction materials. It is envisaged that by 2020 the amount of recycled construction materials used in the construction of buildings with public funds to gradually reach 2%, and in the construction of roads at 10%. In the construction and repair of other technical infrastructures, public entities and private vendors will be required to invest 8% of recycled construction materials by 2020; for the repair roads, this should amount to 3%. In terms of backfilling, contractors will be required to use 12% of construction and demolition waste by 2020. Recycled construction materials that are placed on the market must meet European requirements as well as relevant national legislation. Ordinance on water consumption norms and fee for water abstraction, water use and pollution. The document introduces economic regulation and pricing policy in the water sector, consistent with the polluter pays principle, the principle of reimbursement of the cost of water services, and the adequate contribution of different water users to the reimbursement of costs. This also stimulates innovative technologies and solutions to ensure sustainable distribution and efficient use of water and pollution reduction.

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National Strategy. Progress toward meeting EU targets.

The legal framework is in place, and implementation is underway based on municipal waste management systems with regional disposal and treatment facilities. Inter-municipal associations for regional waste management were created, and by July 2009, 27 regional sanitary landfills complying with EU directives were operational; by end-2009, six more regions anticipated having fully compliant disposal facilities. The National Waste Management Program (NWMP) was updated recently. The 2009-2013 Program incorporates the latest EU Waste Framework Directive (2008/98/EC), including indicative recycling targets, and aims at disposal system environmental compliance and reduced landfill waste. The NWMP aims at full absorption of EU funds allocated to the solid waste sector in the Operational Program Environment (OPE) 2007-2013.

Administration

The municipal administrations are responsible for organising the separate collection of recyclable waste from the households on their territory. For that purpose they should sign a contract with a recovery organisation (RO) or organise the services by themselves. In the contracts with RO the municipalities have two possibilities: to transfer all responsibilities for separate collection of packaging waste to a RO or to organise separate collection by themselves and negotiate and receive from RO additional financing for implementation of separate collection, and eventually sorting and transportation to recycling plants. The Law does not provide a clear guidance on the financial responsibilities of municipalities related to the organisation of municipal waste separate collection services. In practice all municipalities prefer to delegate all financial responsibilities to a RO applying first of the above mentioned options, instead of sharing these costs with the industry. Nevertheless, in limited number of cases the separate collection is financed directly by the municipalities through the municipal waste taxes charged to residents and legal entities in case that contract with RO does not exist. Local level Municipalities shall also adopt municipal waste management programmes as part of their environmental protection programmes. The municipality is responsible for the development of the programme, while the adoption and the control of the implementation of the programme is assigned to the municipal council. Municipal waste management programmes shall be developed in compliance with the structure and the objectives of the NWMP and coincide with its timeframe. The legislation provides the option for several municipalities to participate in a regional waste management association in order to develop a common programme. In such a case, the programme shall include the clear distinction of measures for each municipality. In compliance with the provisions of the 1997 Limitation of the Hazardous Impact of Waste on the Environment Act, most municipalities developed their first municipal waste management programmes. Subsequently, based on adopted amendments to the legislation and depending on specific local conditions, the municipalities either updated their programmes or adopted new programmes. Municipalities have to organise systems for separate collection of household waste from paper and cardboard, metals, plastic and glass, as well as to ensure the availability of conditions for separate collection of waste from packaging for all settlements with a population of more than 5,000 inhabitants and for the resorts. The users of commercial sites, manufacturing, business and administrative buildings in the settlements with more than 5,000 inhabitants and in the resorts are required, as of the beginning of 2013, to separately collect paper and cardboard, glass, plastic and metal wastes in compliance with the ordinances of the municipalities under the Waste Management Act. The Ministry of Environment and Water is the national competent institution in charge of the packaging waste management. The key responsibilities and functions of the Ministry include: development of national legislation and policy in the field; issuing of permits to ROs, implementation of control over their activities, approval of their annual reports; registration, permitting and control of waste collection, sorting, recycling, recovery and disposal activities and control; control over the companies proper reporting of packaging placed on the market by the producers and importers of packed goods; communication and reporting to European Commission. The Ministry is implementing its control functions through a system of 15 Regional Environmental Inspectorates. The Executive Environmental Agency is a structure of the Ministry of Environment in charge with the development and maintenance of national reporting

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system about packaging waste management. The state Enterprise for the management of environmental protection activities (EMEPA) is in charge with the collection and management of product taxes due for the packaging placed on the market.

Waste collection fee. The Local Fees and Taxes Act regulates the fees and taxes, which are determined by the municipalities, and the incomes, which enter the municipal budget, including the household waste tax. The Act regulates for which services the household waste tax needs to be paid by the user, the approach taken in its calculation, which municipal expenditures form the tax and the deadlines for its payment. Bulgaria reported that all landfills which do not comply with EU standards have stopped accepting waste but its implementation record needs to be further improved: as a matter of priority, they need to be definitively closed and rehabilitated, and illegal dumpsites eliminated. Despite significant progress in the closure of noncompliant sites, their rehabilitation remains a challenge. In 2013, Bulgaria introduced a law that required waste collection fees to be calculated based on the generated waste (the ‘pay-as-you-throw’ principle), instead of being based on the value of the real estate property. It was due to enter into force on 1 January 2015 but this has been postponed a number of times, the last target date being 1 January 2018. In October 2017, an amendment to the Law on Local Taxes and Fees clarified the methods for calculating costs and waste collection fees, but further postponed the implementation of the polluter-pays principle until 1 January 2020. All municipalities are obliged to collect at least four recycling streams, plus biodegradable waste. There is no door-to-door collection for these, and waste collection points are mainly for packaging materials, such as glass, metal and plastic, paper and residual waste. Currently, the waste fee in Bulgaria is based on the property value of the waste holders and varies in different regions and municipalities. An act for local taxes currently is under development to oblige all municipalities from 2014 onwards to implement “pay as you throw” principle and to change the structure of municipal waste fee in accordance with the waste amount generated by each household. A landfill tax has been introduced to municipal waste starting from EUR 1.5/t in 2011 and increasing to EUR 17.5/t in 2014. The waste management fees for citizens set by the Municipalities are currently based on the value of the real estate and included in municipal taxes and are therefore not taking into account the generated waste quantities. However, legal bodies (companies, institutions, hospitals, etc.) are able to optimise the waste management fee by declaring the number of containers in use and the proposed collection frequency. There is an on-going project for the development of regulations on bio-waste management and establishment of a system for ensuring quality. The EC is referring Bulgaria to the EU Court of Justice for failing to meet the December 2010 deadline to transpose the WFD.

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Conclusions

In the recent decades huge amount of legislative policies and strategies were adopted in EU and all member states were obliged to harmonise their legal framework to EU objectives and to develop and implement the strategies concerning air, water and soil preservation as well as improvement of waste disposal and management according to the problematic and separate necessities of each country. As the current study indicated, these challenges were perceived by the member states and resulted in improvement in vast majority of environmental indicators set by EU for 2020.

The study provided systematic and detailed data on sustainable and working models for waste management in 5 counties with measures and green approaches for retrieval of their environment leading to the next step in their sustainable development for the next target period as into 2050. The study also described the countries' policies and strategies with actual trends in their implementation towards greener and cleaner environment. According to the obtained data the policies and legal framework in BG-SR CBC follow all EU rules and fit the legal policies evenly to other EU countries, and to adopted measures and approaches at international level. As a significant drawback for both countries is the weak presentation of green practices and innovative solutions in the field of air, water and soil improvement as well as in waste disposal and management field. The legislation and sustainable strategies were well suited to the environmental issues in the region but their implementation is lagging far behind other countries like Estonia, which was at the bottom of the EU indicator's scales and today is climbing rapidly to the leading positions. Both countries should take experience from the leader in the rankings. Nevertheless, Denmark is the largest waste producer per capita in EU, the implementation of good practices in the circular economy has encouraged the country for setting the goals of achieving 30% decrease in waste volume by 2030 and one half of household waste to be recycled by 2022. Portugal has experienced the fastest growth in innovation performance among EU member states in recent years. A good example for that is the intelligent waste management system implemented in some cities. The innovative system maximise the use of urban space and minimise the cost for municipal waste services. Japan, as a country with a long tradition, bases its environmental policy on laws adopted several decades ago, but has managed to develop and implement innovative solutions and technological advances to pursue a successful and sustainable environment accomplishments. New Zealand is a country with almost zero air pollution and exceptional natural resources, which addresses environmental challenges by demonstrating a personal attitude towards the nature.

All these examples give a broad view and provide an arena for the practical strategic implementation of green approaches and solutions for sustainable conservation and restoration of the environmental resources in the BG-RS CBC region.

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Abreviations

ANREEE	Association National For The Registration Of Electrial and Electronic Equipment
ASIE	Advanced Sports Installations Europe As
BAT	Best Available Techniques
BISE	Biodiversity Information System For Europe
BMW	Biodegradable Municipal Waste
BOCM	Bilateral Offset Crediting Mechanism
BOD	Biological Oxygen Demand
BOO	Base Of Operations
BP	Biocidal Products
BPA	Bisphenol A
CAI	Clean Asia Initiative
CAP	Common Agriculture Policy
CBD	Convention On Biological Diversity
CBRN Defense	Chemical, Biological, Radiological And Nuclear Defence
CE	Circular Economy
CECIS	Common Emergency Communication And Information System
CFP	Carbon Footprint
CFP	Common Fisheries Policy
CHP	Coordination Of Humanitarian Affairs
CLP	Classification, Labelling And Packaging
CMS	Chemical Management Services
COD	Chemical Oxygen Demand
CPE	Command Post Exercises
DOC	Department Of Conservation
DRR	Disaster Risk Reduction
EAP	Environment Action Programme
ECHA	European Chemicals Agency
ECHO	EU Humanitarian Aid Department
ECPP	European Civil Protection Pool
EEA	European Economic Area
EECA	Energy Efficiency And Conservation Authority
EEZ	Excusive Economic Zones
EFSA	European Food Safety Authority
EIB	Energy Intensive Business
EIPs	Eco-Industrial Parks
EMAS	Eco-Management And Audit Scheme
EMEPA	Enterprise For The Management Of Environmental Protection Activities
EMFF	European Maritime And Fisheries Fund
EMS	Environmental Management System
EMSA	European Maritime Safety Agency
EMT	Emergency Medical Teams
EPA	Environmental Protection Authority
EPR	Extended Producer Responsibility
E-PRTR	European Pollutant Release And Transfer Register
ERB	Estonian Rescue Board
ERCC	Emergency Response Coordination Centre
ERDF	European Regional Development Fund
ERP	European Recycling Platform
ESIF	European Structural And Investment Fund
ETS	Emissions Trading System
EUCPT	European Union Civil Protection Team
EUDN	European Urban Development Network
FIDA	Forest Industry Development Agenda

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FSE	Full Scale Exercises
GDP	Gross Domestic Product
GGC	Green Growth Commitment
GHG	Greenhouse Gas
GPN	Green Purchasing Network
GPP	Green Public Procurement
GWPH	Global Warming Prevention Headquarters
HCP	High Capacity Water Pumping
IAS	Invasive Alien Species
ICROFS	International Center For Research In Organic Agriculture And Food Systems
IEA	International Energy Agency
IED	Industrial Emissions Directive
IMO	International Maritime Organisation
INDC	Intended Nationally Determined Contribution
ISO	International Organisation For Standardisation
IUCN	International Union For Conservation Of Nature
JEA	Japan Environment Association
JICA	Japan International Cooperation Agency
LCI	Life Cycle Inventory
LCIA	Life Cycle Impact Assessment
LCM	Life Cycle Management
LUCAS	Land Use And Coverage Area Frame Survey
LULUCF	Land Use, Land-Use Change And Forestry
MBT	Mechanical Biological Treatment
METI	Ministry Of Economy, Trade And Industry
MIC	Monitoring And Information Centre
MLIT	Ministry Of Land, Infrastructure, Transport And Tourism
MOE; MfE	Ministry Of The Environment
MOR	Organised Waste Market
MSFD	Marine Strategy Framework Directive
MSW	Municipal Solid Waste
NAP	National Action Plan
NDC	Nationally Determined Contribution
NECPs	National Energy And Climate Plans
NEDO	New Energy And Industrial Technology Development Organization
NESs	National Environmental Standards
NGOs	Nongovernmental Organisations
NPO	Non-Profit Organisation
NPSs	National Policy Statements
NRS	The Natural Resources Sector
NWMP	National Waste Management Plan
NZ ETS	New Zealand Emissions Trading Scheme Packaging Waste
NZBS	New Zealand Biodiversity Strategy
OCHA	Office For The Coordination Of Humanitarian Affairs
OECD	Organisation For Economic Co-Operation And Development
OHSMS	Occupational Health And Safety Management System
OSOCC	On-Site Operations Coordination Centre
PAH	Poly-Aromatic Hydrocarbons
PAT	Plasma Arc Technology
PBT	Bioaccumulative and toxic
PCB	Polychlorinated Biphenyls
PCR	Product Category Rule
PCT	Polychlorinated Terphenyls
PDNA	Post Disaster Needs Assessment
PFOS	Perfluorooctane Sulfonate
PM	Particulate Matter

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POPs	Persistent Organic Pollutants
PPP	Plant Protection Products
PSS	Product-Service Systems
PV	Photovoltaic
PW	Packaging Waste
R&D	Research And Development
RBPS	Risk Based Process Safety
RDEs	Real Driving Emissions
RED	Renewable Energy Directive
RISE	Response-Inducing Sustainability Evaluation
RMA	Resource Management Act
RO	Recovery Organisation
SAR	Specific Absorption Rate
SBIR	Small Business Innovation Research
SCP	Sustainable Consumption And Production
SDGs	Sustainable Development Goals
SDS	Safety Data Sheets
SFF	Sustainable Farming Fund
SITR	Social Investment Tax Relief
SLCA	Strategic Life Cycle Assessment
SMEs	Small And Medium-Sized Enterprises
SOPs	Standard Operating Procedures
SVHC	Substances Of Very High Concern
TAST	Technical Assistance Support Teams
TFEU	Treaty On The Functioning Of The European Union
TMG	Tokyo Metropolitan Government
TTE	Table Top Exercises
TUPPAC	Transforming Urban Planning Providing Autonomous Collective Mobility
UCC	USAR Coordination Centre
UCPM/CPM	Union Civil Protection Mechanism
UDN	Urban Development Network
UIA	Urban Innovative Actions
UN	United Nations
UNFCCC	United Nations Framework Convention On Climate Change
USAR	Urban Search And Rescue
VAP	Voluntary Action Plan
VOCs	Volatile Organic Compounds
WFD	Water Framework Directive
WQES	Water Environment Quality Standard

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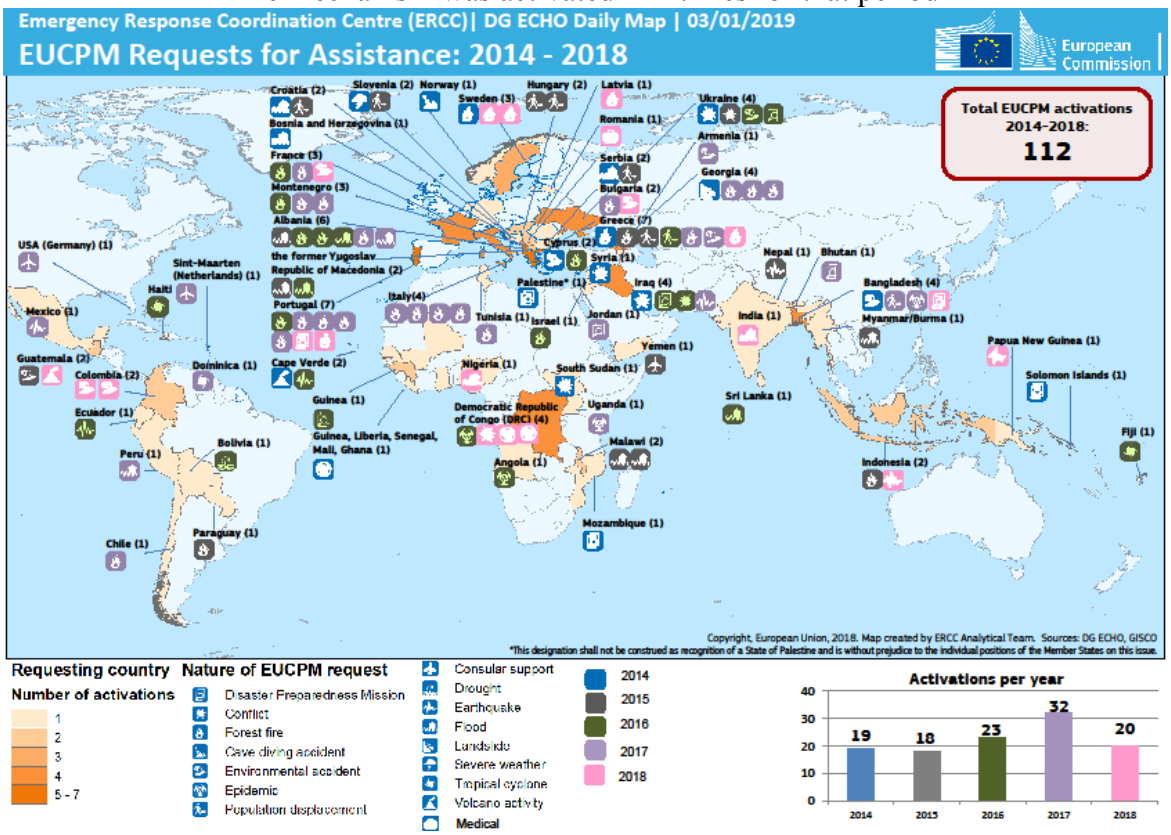
Annexes

UCPM Requests for Assistance: 2014-2018.
The mechanism was activated 122 times for that period



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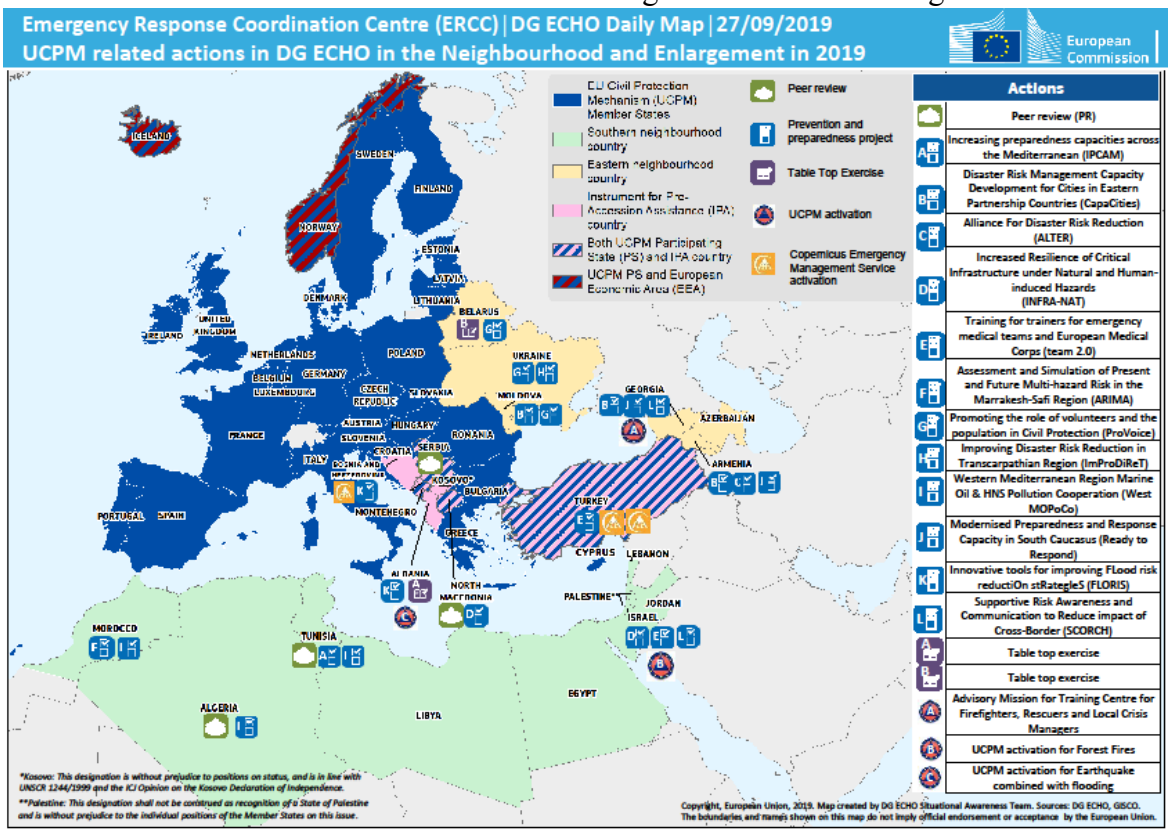
UCPM related actions in DG ECHO in the Neighbourhood and Enlargement in 2019



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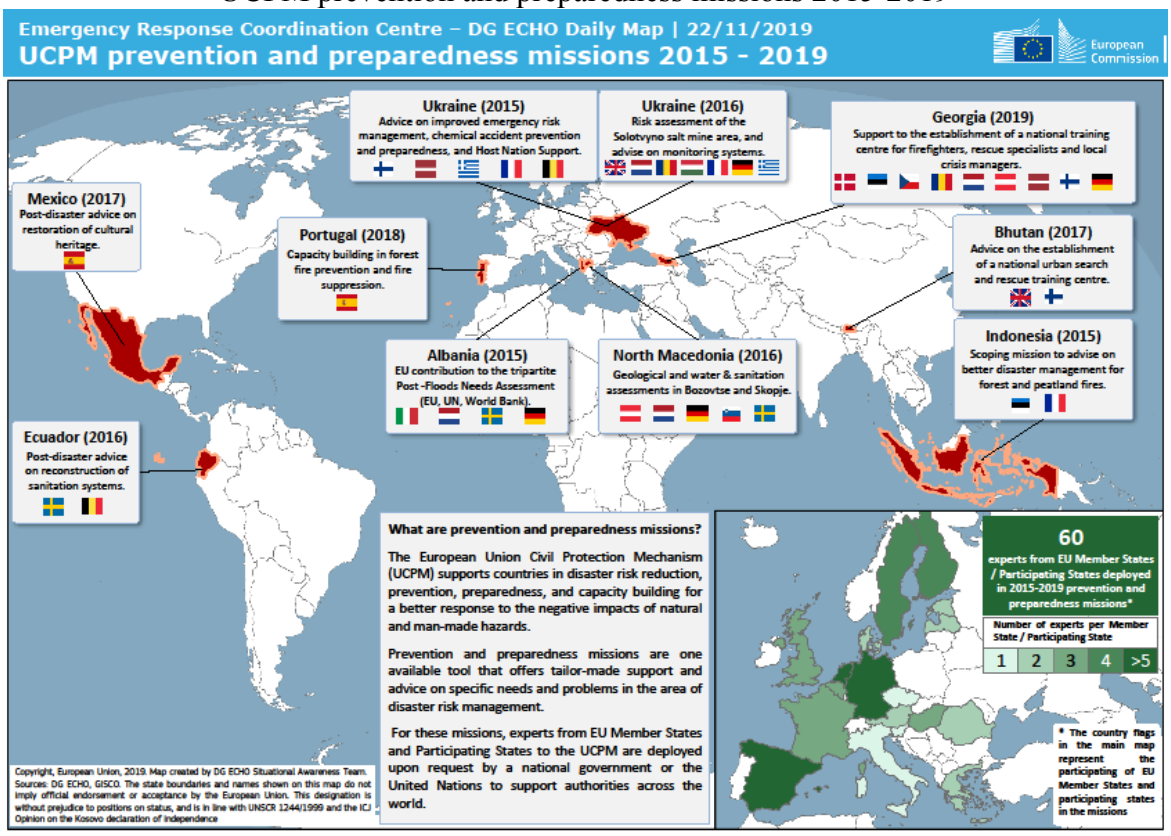
UCPM prevention and preparedness missions 2015-2019



UCPM Request for Assistance in 2019 (20 activations)

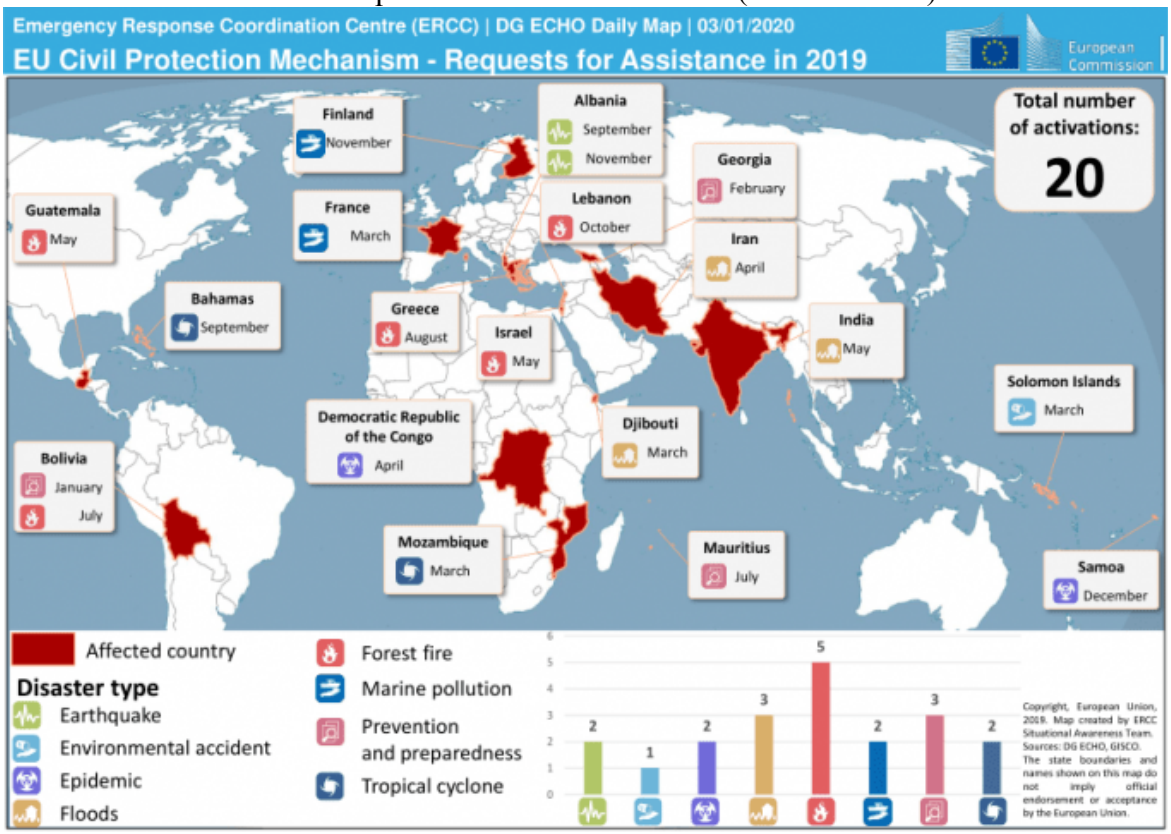


Figure 3 – Waste hierarchy

Source: European Commission.

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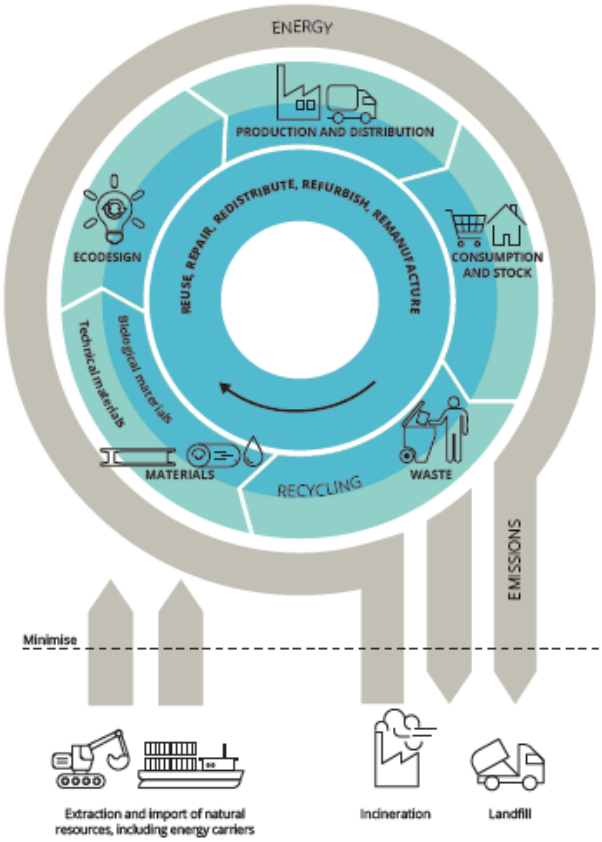
FIGURE 9.1 Circular economy system diagram



Source: EEA (2016a).

Thematic summary assessments of EU trends and policies :

- **Biodiversity**

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets
	Past trends (10-15 years)	Outlook to 2030	2020
Terrestrial protected areas	Improving trends dominate	Developments show a mixed picture	☑ Largely on track
EU protected species and habitats	Trends show a mixed picture	Developments show a mixed picture	☒ Not on track
Common species (birds and butterflies)	Deteriorating trends dominate	Deteriorating developments dominate	☒ Not on track
Ecosystem condition and services	Deteriorating trends dominate	Developments show a mixed picture	☒ Not on track

- **Climate change**

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Theme	Past trends and outlook		Prospects of meeting policy objectives/targets		
	Past trends (10-15 years)	Outlook to 2030	2020	2030	2050
Greenhouse gas emissions and mitigation efforts	Improving trends dominate	Developments show a mixed picture	☑ Largely on track	☒ Largely not on track	☒ Largely not on track
Energy efficiency	Improving trends dominate	Developments show a mixed picture	☐ Partly on track	☒ Largely not on track	☒ Largely not on track
Renewable energy sources	Improving trends dominate	Developments show a mixed picture	☑ Largely on track	☒ Largely not on track	☒ Largely not on track
Climate change and impacts on ecosystems	Deteriorating trends dominate	Deteriorating developments dominate	☒ Largely not on track		
Climate change risks to society	Deteriorating trends dominate	Deteriorating developments dominate	☐ Partly on track		
Climate change adaptation strategies and plans	Improving trends dominate	Improving developments dominate	☐ Partly on track		

- **Freshwater**

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets
	Past trends (10-15 years)	Outlook to 2030	2020
Water ecosystems and wetlands	Trends show a mixed picture	Developments show a mixed picture	☒ Not on track
Hydromorphological pressures	Deteriorating trends dominate	Developments show a mixed picture	☒ Not on track
Pollution pressures on water and links to human health	Trends show a mixed picture	Developments show a mixed picture	☒ Not on track
Water abstraction and its pressures on surface and groundwater	Improving trends dominate	Developments show a mixed picture	☒ Not on track

- **Land and soil**

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets	
	Past trends (10-15 years)	Outlook to 2030	2020	2050
Urbanisation and land use by agriculture and forestry	Deteriorating trends dominate	Deteriorating developments dominate		☒ Not on track
Soil condition	Deteriorating trends dominate	Deteriorating developments dominate	☒ Not on track	

- **Air pollution**

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Theme	Past trends and outlook		Prospects of meeting policy objectives/targets	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Emissions of air pollutants	Trends show a mixed picture	Trends show a mixed picture	☑ Largely on track	☐ Partly on track
Concentrations of air pollutants	Improving trends dominate	Trends show a mixed picture	☒ Largely not on track	☑ Largely on track
Air pollution impacts on human health and well-being	Improving trends dominate	Trends show a mixed picture		☑ Largely on track
Air pollution and impacts on ecosystems	Trends show a mixed picture	Trends show a mixed picture	☐ Partly on track	☐ Partly on track

- **Waste and resources in a circular economy**

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets	
	Past trends (10-15 years)	Outlook to 2030	2020	2030
Circular use of materials	Improving trends dominate	Developments show a mixed picture		☐ Partly on track
Material resource efficiency	Improving trends dominate	Developments show a mixed picture	☑ Largely on track	
Waste generation	Trends show a mixed picture	Developments show a mixed picture	☐ Partly on track	
Waste management	Improving trends dominate	Improving developments dominate	☐ Partly on track	

- **Chemical pollution**

Theme	Past trends and outlook		Prospects of meeting policy objectives/targets
	Past trends (10-15 years)	Outlook to 2030	2020
Emissions of chemicals	Trends show a mixed picture	Deteriorating developments dominate	☒ Largely not on track
Chemical pollution and impacts on ecosystems	Trends show a mixed picture	Deteriorating developments dominate	☒ Largely not on track
Chemical pollution and risks to human health and well-being	Trends show a mixed picture	Deteriorating developments dominate	☒ Largely not on track

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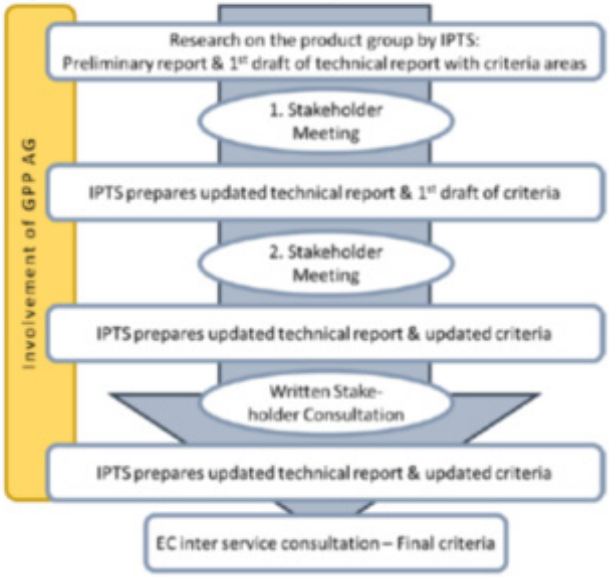
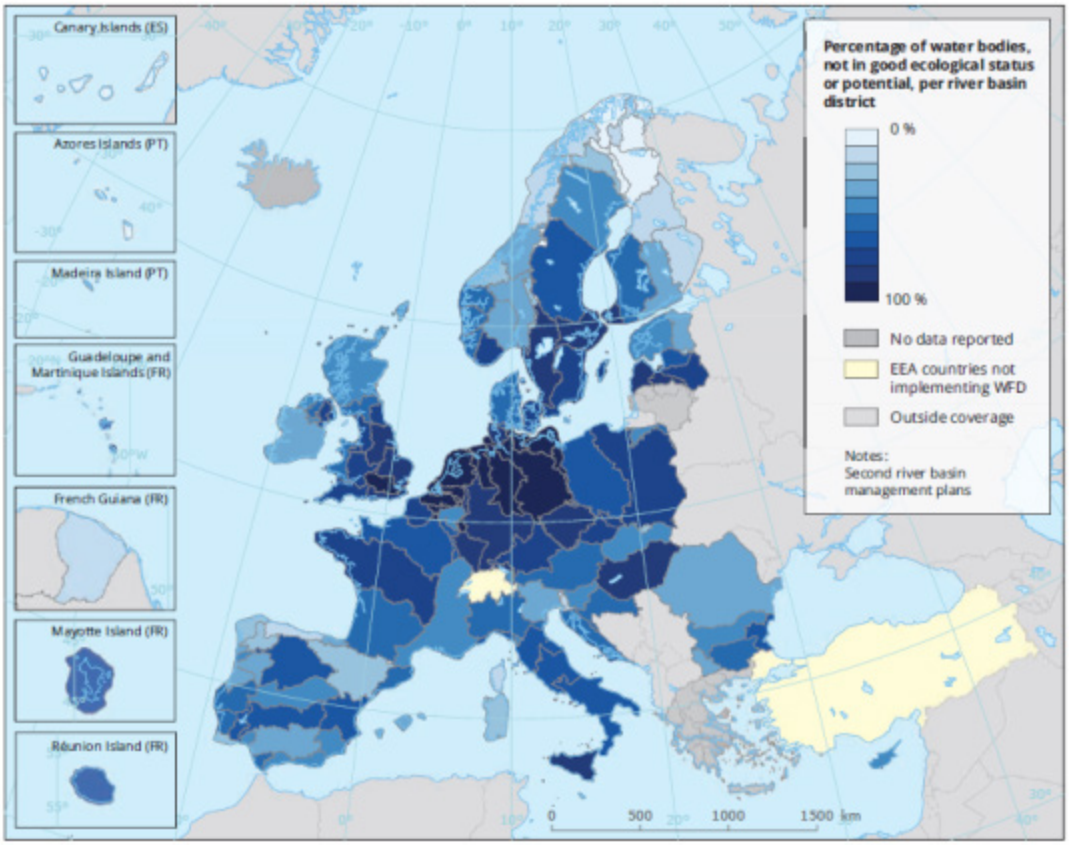
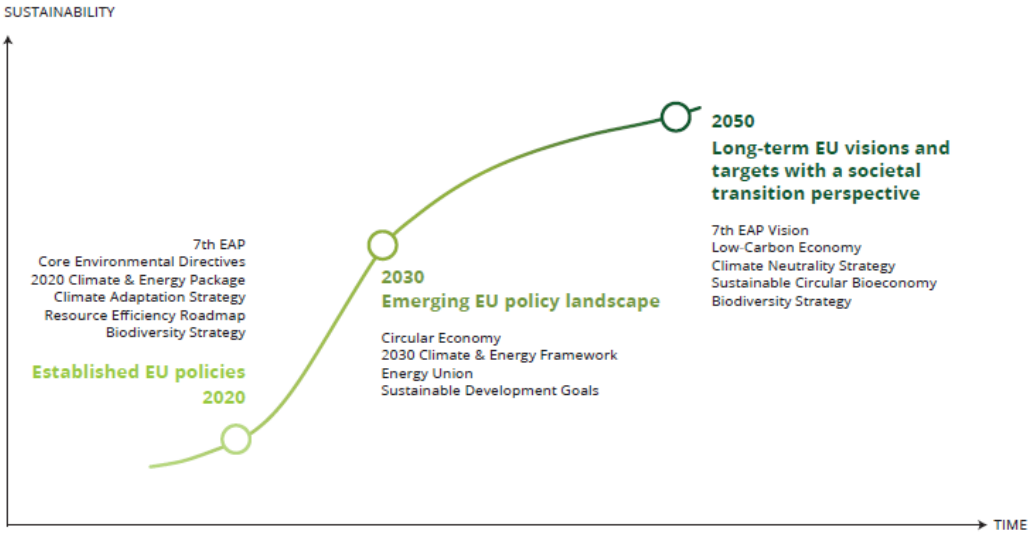
Process for the development and revision of GPP criteria (adopted according to EC GPP web 2017)



MAP 4.1 **Country comparison — results of assessment under the Water Framework Directive of ecological status or potential shown by river basin district**

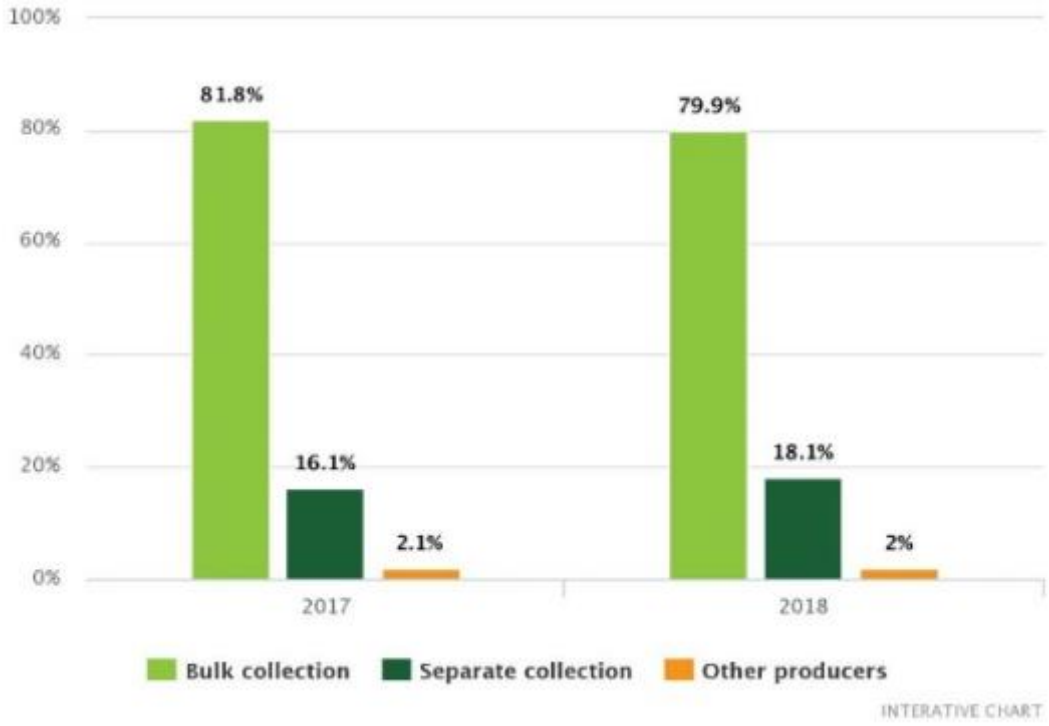



SUSTAINABILITY
7th EAP
Core Environmental Directives
2020 Climate & Energy Package
Climate Adaptation Strategy
Resource Efficiency Roadmap
Biodiversity Strategy
Established EU policies
2020
2030
Emerging EU policy landscape
Circular Economy
2030 Climate & Energy Framework
Energy Union
Sustainable Development Goals
2050
Long-term EU visions and targets with a societal transition perspective
7th EAP Vision
Low-Carbon Economy
Climate Neutrality Strategy
Sustainable Circular Bioeconomy
Biodiversity Strategy
TIME

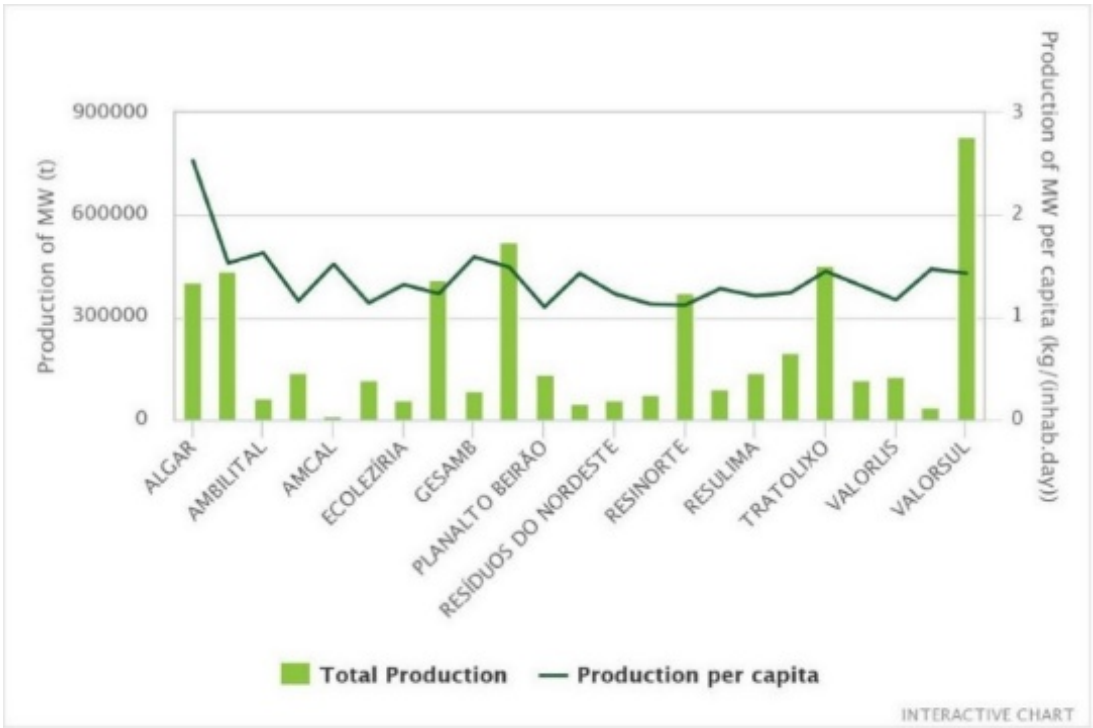
Source: EEA.


6000000
4800000
3600000
2400000
1200000
0
Production of MW (t)
1.6
1.5
1.4
1.3
1.2
1.1
Production per capita (kg/inhab.day)
2010
2011
2012
2013
2014
2015
2016
2017
2018
Total of MW (t)
Production per capita
INTERATIVE CHART

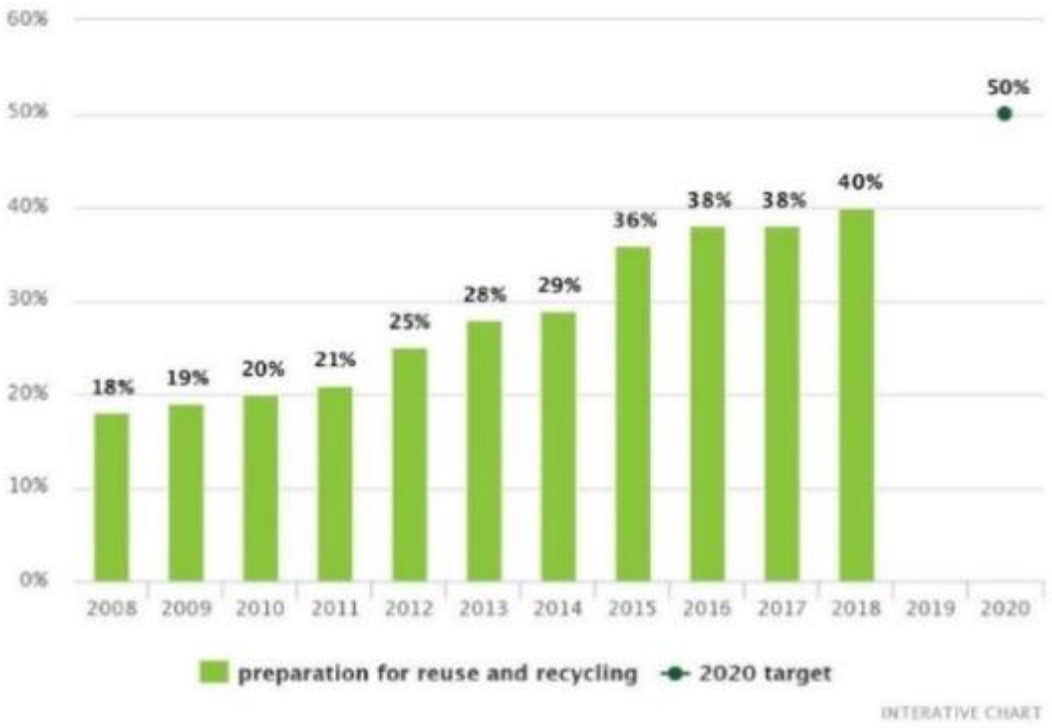
Production of municipal waste in mainland Portugal, total and per capita Source:APA, 2019



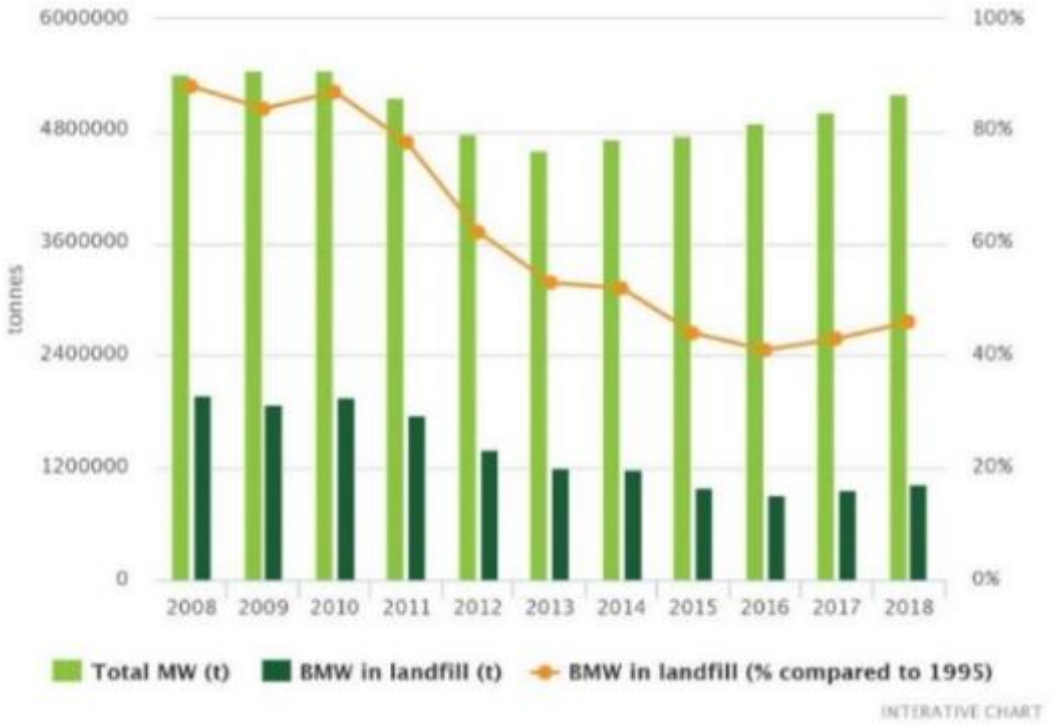
Municipal waste collection in mainland Portugal Source: APA, 2019



Municipal waste production per Municipal Management System, total and per capita Source: APA, 2019



Rate of preparation for reuse and recycling in Portugal Source:APA, 2019



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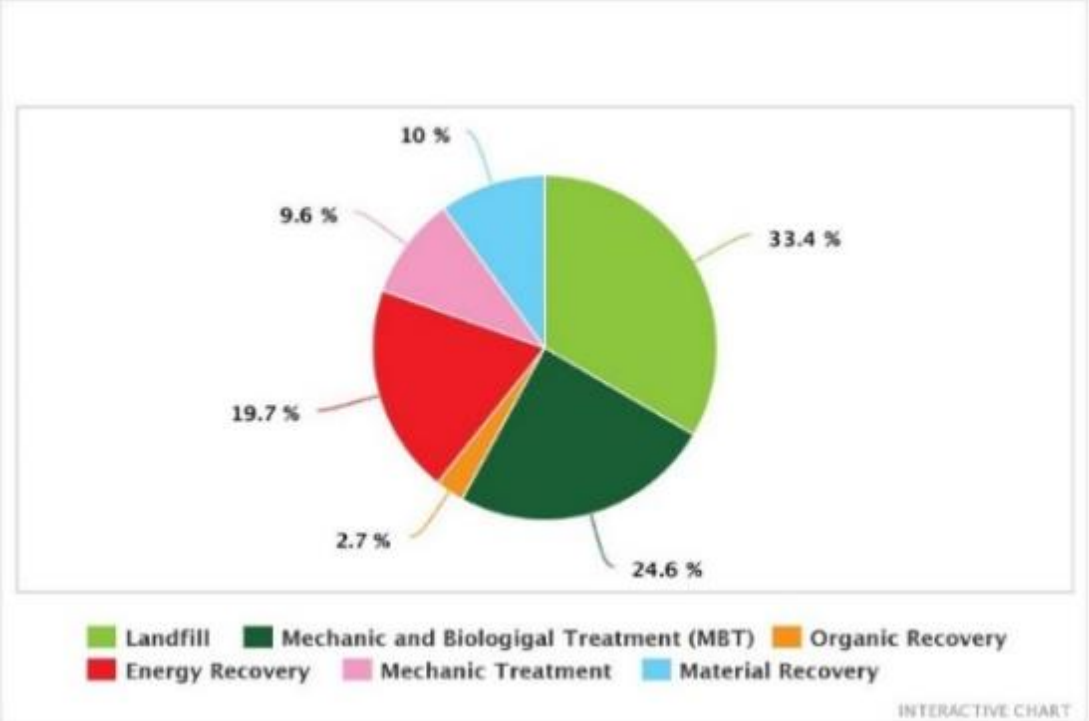
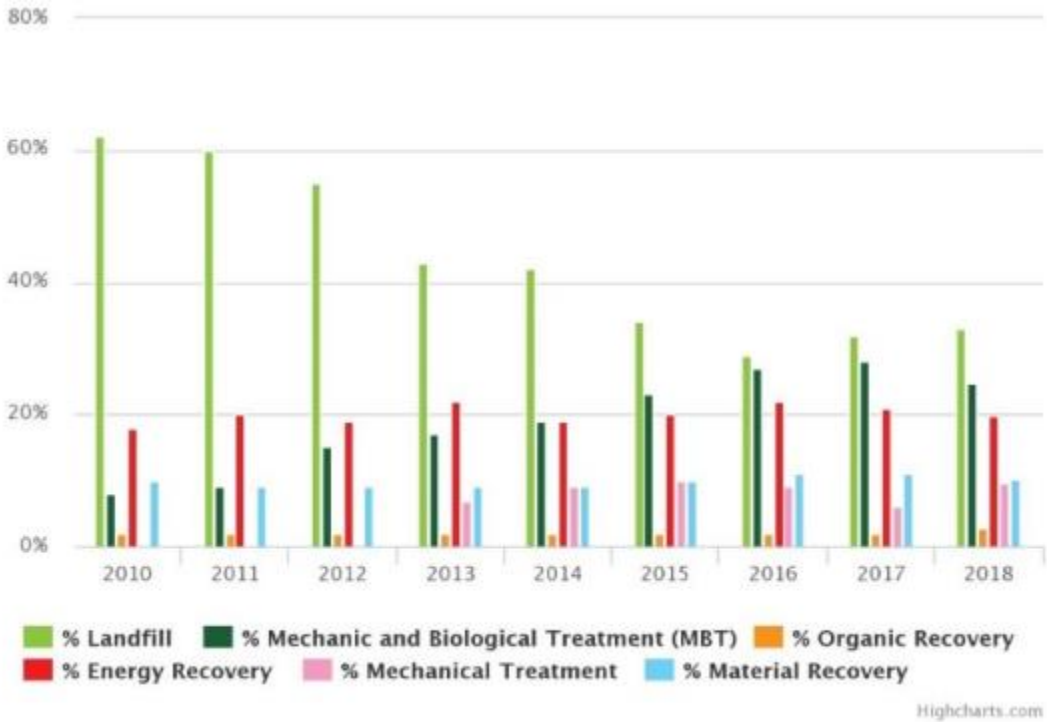
Diversion of biodegradable municipal waste from landfill Source: APA, 2019



Municipal waste per management operation in mainland Portugal, in 2018

Source: APA, 2019



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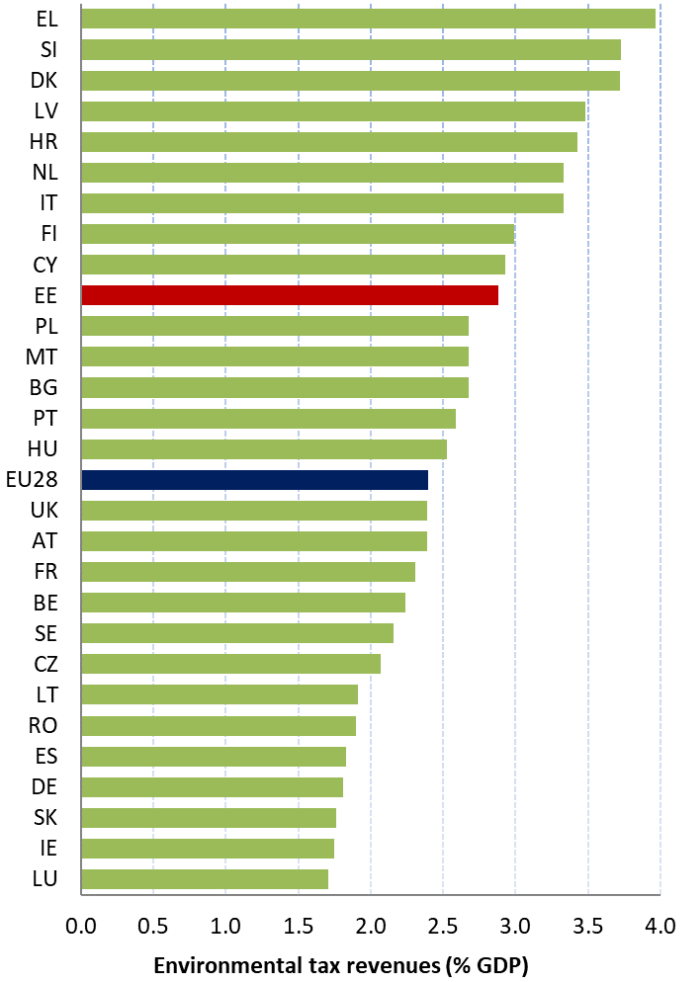
Evolution of MW per management operation, in mainland Portugal Source: APA, 2019



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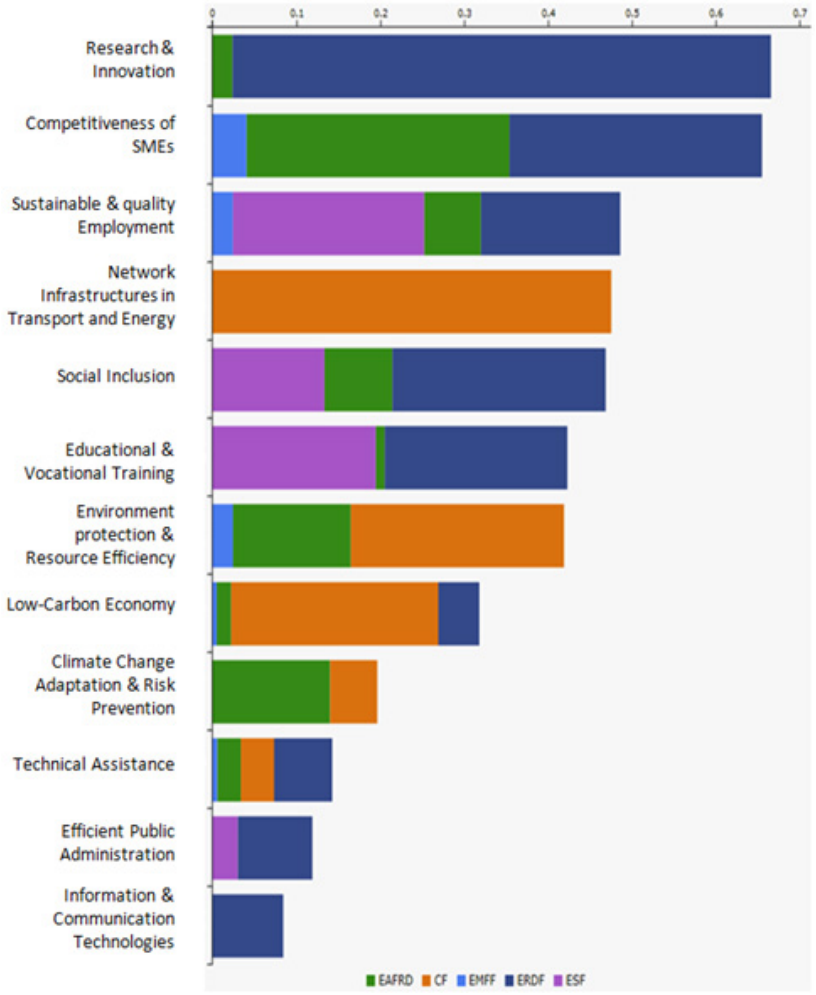
Environmental tax revenues as % of GDP in EU, 2017



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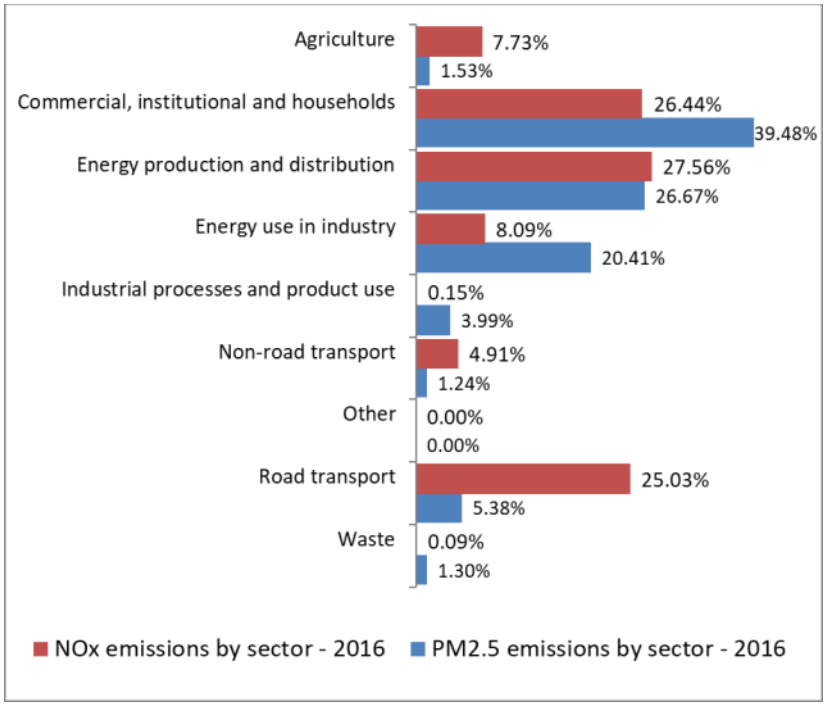
ESIF 2014-202 – EU allocation by theme, Estonia (EUR billion)



PM2.5 and NO_x emissions by sector in Estonia

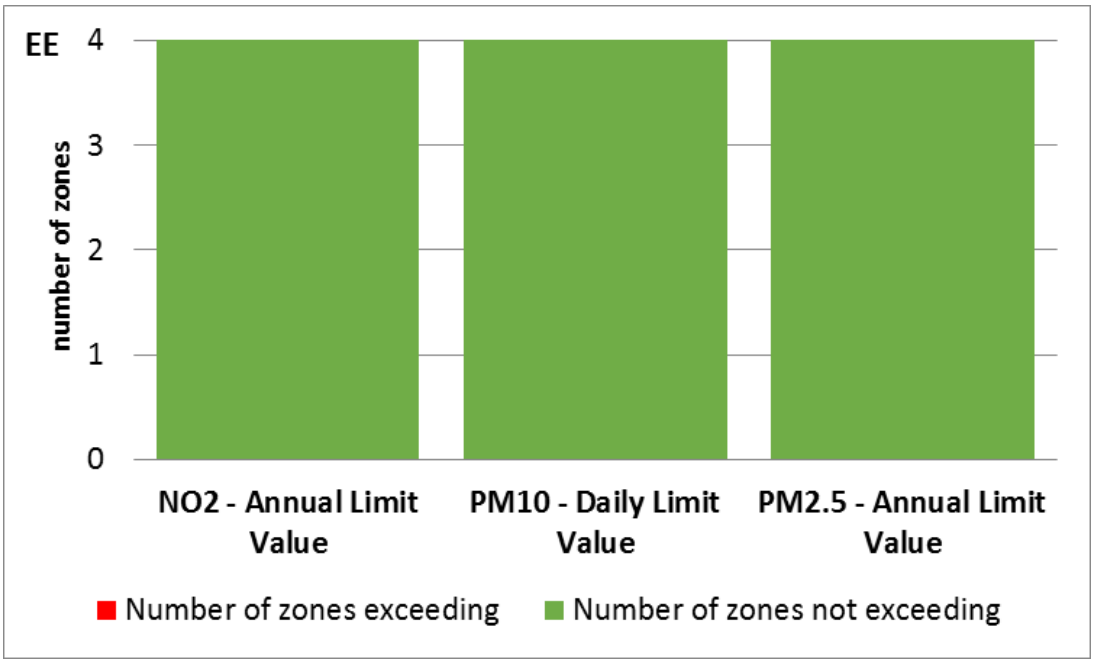


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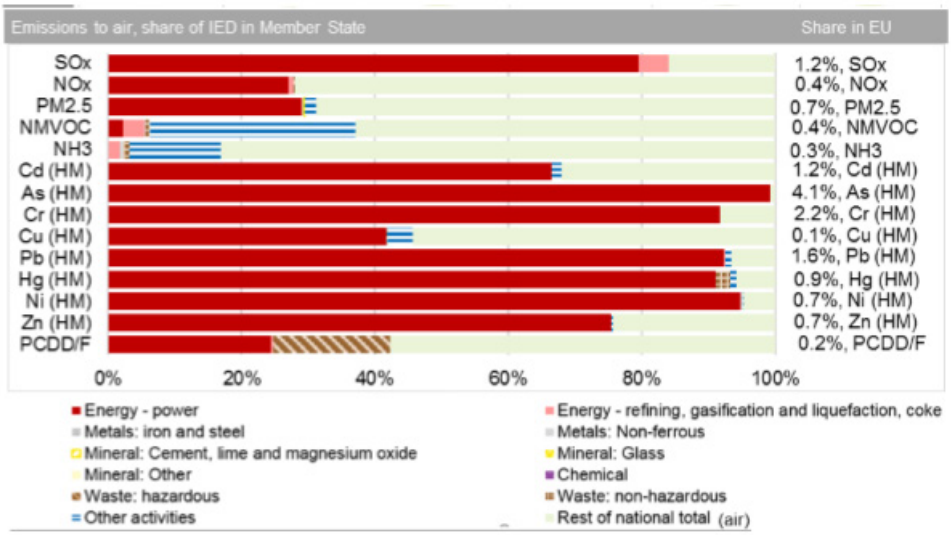
Figure . Air quality zones exceeding EU air quality standards in 2017. Industrial emissions



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Emissions to air from IED sectors and all other national total air emissions, Estonia (2015), Source: Environmental Implementation Review 2019, Country Report 2019

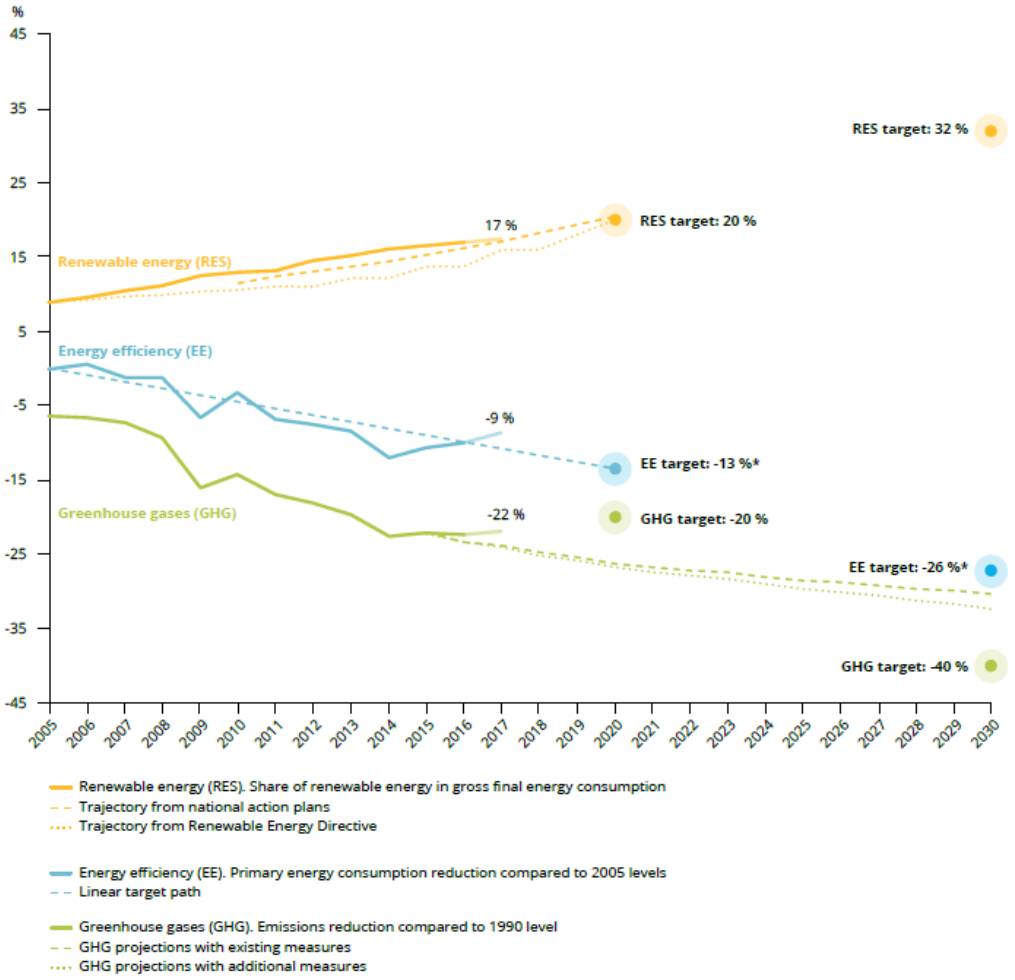

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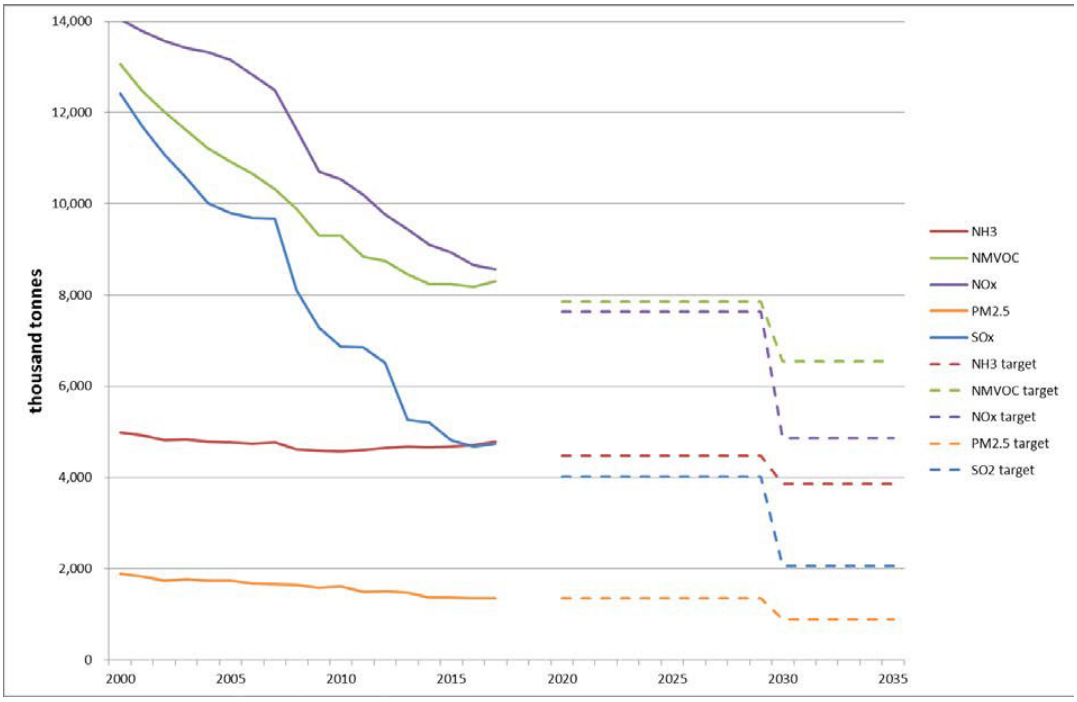
Figure . EU progress towards 2020 and 2030 targets on climate and energy; Source: EEA, 2018e



Emissions and target levels of the main air pollutants, Source: EEA 2019

Making cities more sustainable

Europe's most sustainable islands are Danish

The Danish islands of Bornholm and Samsø have come take the top spots in an EU-wide sustainability competition. Their success is based on engaging all sectors of society in delivering a sustainable future and putting the community at the centre of the development. However, Bornholm can now more than ever own up to its other nickname as the 'Bright Green Island' as it has just been named Europe's most sustainable island. Bornholm is the first ever winner of the RESponsible Island prize given by the European Commission for an extraordinary contribution to a sustainable and climate-friendly Europe. Among many green initiatives, Bornholm early on began phasing out coal and oil, led by the regional municipality. The island has also developed a 100 per cent renewable energy system that combines solar cells, wind turbines, biomass and district heating. Samsø has succeeded in switching from imported fossil fuels to local renewable energy and putting its community in the centre of the transition for their benefit. A common denominator for both islands is that the noteworthy sustainable actions followed after crises. After the fish stocks crashed in 1990's, Bornholm needed to find new ways to create jobs and become self-sufficient. Sustainability became the answer, and Bornholm has, for instance, erected 35 large wind turbines and several biomass plants on the island. Therefore, getting the recognition from the European Commission was a green milestone. Similarly, Samsø found itself in a crisis in the 1990's, which challenged the island to find innovative solutions. Focusing on phasing out imported fossil energy replaced with locally produced green energy, Samsø took the matter

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into its own hands and started a new era to become both economically and socially sustainable. As a living laboratory, Samsø has since created a national and global network that is of great importance for the continued sustainable development,” said Søren Hermansen, Director of the Energy Academy at Samsø in a press release. The two sustainable islands still have ambitious green plans for the future. Bornholm aims to become CO_2 neutral by 2025, waste-free by 2032 and a zero-emission community by 2035. Samsø’s ambition is to become fossil free by 2030, 20 years ahead of Denmark as a country. The “RESponsible Island Prize” honours islands that do a particularly great job within the green transition. The prize is awarded by the EU’s Horizon 2020 program, and with the rankings come EUR 500,000 for Bornholm and USD 250,000 for Samsø. The third place went to the British Orkney. A number of cases on how Danish Architectural Firms uses planning, architecture and the landscape to create value with less impact on the climate and to protect Danish assets against climate change. The cases illustrate how green architecture in different ways implement innovative solutions and prompt to ‘think new’ in the green transition. For example, in Copenhagen the Climate Tile, a pavement system for collecting and recycle rainwater to be used as a positive resource. In a small coastal city, a climate-proofing wall protects the city and local against high tide caused by storms and has turned the harbour area into an exciting public space. Using rain as a resource. Developed for the sidewalks and urban spaces of the future. The climate tile can handle both the effects of climate change and create new experiences in the city.The tile is a system of paving tiles that collect and reuse precipitation, so that the water collected can eventually be used as a resource. An invisible climate solution that doesn’t interfere with pedestrians or with the urban landscape.

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Photo: Tredje Natur
Location Copenhagen
Function Water Discharge
Completed 2018
Architect THIRD NATURE

Novo Nordisk Nature Park

Biodiversity in Bagsværd. Lush nature, insects and dead trees adorn one of Denmark's most successful companies. Biodiversity is a general motif in the Novo Nordisk Nature Park, where employees can enjoy a whiff of fresh air among the trees and the gently winding paths. The park has minimum operating costs and moreover collects the rainwater that falls in the park area and runoff from the surrounding buildings. The landscape is resilient to climate change and provides added green value and significant financial savings.

Cover/Photo: Torben Petersen
Location Bagsværd
Function Natural Park
Completed 2014
Landscape SLA Architects
Collaborators Henning Larsen

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Le Mur

Climate-proofing gives local anchorage. Le Mur protects Lemvig against high tide caused by storms. In everyday life it creates life at the harbour. The Le Mur flood-protection works have saved the harbour town of Lemvig at least DKK 30 mill. in repair costs. Besides protecting Lemvig during high water levels of up to 210 cm above normal, Le Mur serves as a meeting point and resting area at the harbour. The wall has been constructed from concrete and can be closed with steel gates when a storm is imminent.

Photo: Kontraframe

FACTS

Location Lemvig

Function High-water Furniture

Completed 2012

Architect Hasløv & Kjærsgaard Architects

Engineer COWI, Grontmilj

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In-situ remediation

Many different methods for in-situ remediation exist, and the challenge is to choose the combination of methods which is most cost-effective and sustainable given the conditions of the site and the environment in the vicinity.

In-situ chemical oxidation

In-situ chemical oxidation (ISCO) is a useful method for removing most types of chlorinated solvents, and light and heavy petroleum, as well as many types of pesticides. The method can also be used to remediate PAH contamination. The ISCO approach employs strong oxidants, such as ozone, permanganate or hydrogen peroxide, to destroy any problematic contaminants in the subsurface. Successful use of the method is dependent on the level of contact between the pollutant and the oxidant as well as an in-depth knowledge of the natural chemistry of the soil.

Studies show that ISCO is especially efficient in a treatment train approach, where the method is deployed in combination with other technologies.

Soil vapour extraction and air sparging

Soil vapour extraction (SVE) is not the most widely used method in Denmark, where the geological conditions with lots of clay in many places limits its efficiency. Nevertheless, most of the major Danish consultancies working within the sector often make use of the method in connection with other in-situ methods such as thermal remediation and air sparging. The technique is primarily applicable for the remediation of chlorinated solvents, petrol, petroleum, and turpentine. As a further benefit, the natural microbial degradation of the contaminants is enhanced due to the inlet of oxygen caused by the method. SVE is often used in connection with air sparging, which is based on the injection of air into the subsurface of the saturated zone in order to turn dissolved hydrocarbons into vapour which can be vented from the soil.

In-situ thermal remediation

Several techniques for thermal remediation exist. Common to them all is a very high removal efficiency, sometimes up to 99.9%, and a short execution time. However, this comes at a cost, and the techniques are often energy intensive. For several years, the Danish Company Krüger A/S14 has been using in-situ thermal desorption (ISTD) in the form of conductive heating as a remediation technique. So far, six full-scale remediation projects as well as a number of demonstration projects and pilot tests have been conducted in Denmark using ISTD. The patented technique has several advantages, including short operation time, insensitivity to geological differences, no excavation needed, and a very high remediation efficiency. Besides this, conductive heating is the only method to raise the soil temperature significantly enough to treat heavier boiling components such as PCBs, dioxin, and lindane.

Another successful technique for in-situ thermal remediation is Electrical Resistance Heating (ERH). The method takes advantage of the soil's natural electrical resistance to heat up the soil.

An alternative approach to in-situ thermal remediation is Steam Enhanced Extraction (SEE), which makes use of heated steam to remove the contaminants from the soil. The SEE approach is especially efficient for remediation in permeable sediments below the water table. The method can be combined with ERH and ISTD. This has been done in a Danish project by the companies Arkil A/S and Krüger A/S.

Besides the above-mentioned common approaches to in-situ thermal remediation, various alternative methods are constantly being tested in Denmark. One example is the use of radio frequency heating

Phytoremediation

Remediation of contaminated soil using green plants and trees - phytoremediation

- has received some attention in Denmark where several tests of different phytoremediation methods have been conducted.

One example is a current project being conducted by the Capital Region of Denmark in collaboration with GEO A/S, which aims to clarify the heavy metal uptake potential of a specific tropical fern. Even though phytoremediation can be used for remediating organic pollutants as well as heavy metals, the method is not deployed very often as the remediation process is very time consuming and only suitable for contamination near to the surface. Nevertheless, the method can be a useful supplement to other remediation techniques if the right conditions are present. The Danish company Arresø Pil is one of the companies which deploys this method

Indoor climate management

As a natural consequence of the relative pressure under a building, there is a risk of contaminated soil gas seeping through the building envelope and entering the indoor climate. The soil gas most often enters through cracks and fissures in the floor slab, but in recent years significant transport of contaminants through other pathways, including sewage pipes, has also been documented.

Recently, indoor climate management in relation to contaminated soil gas has received a lot of attention in Denmark where several R&D projects have been set in motion in order to determine the entrance routes of the soil gas and possible ways of sealing the building envelope. Experience has shown that sealing the building envelope can limit the contamination level by a factor of 10, and if the sealing is done in connection with other remediation measures, then the pollutant concentration in the indoor environment is reduced by a factor of up to 200.

Ex-situ remediation

Traditional remediation involves excavating the contaminated soil and disposing of it in another location. In Denmark, it is estimated that approximately 80% of all remediation processes take place ex-situ, meaning that the contaminated soil is first excavated and transported away from the contaminated site. Over the years, a so-called pre-classification of soil before excavation has been developed by Danish consultants to optimize the costs of ex-situ remediation. This means that the soil to be excavated is classified according to its level of contamination prior to excavation through a network of boreholes and soil sampling at different depths. During excavation the soil can then be separated into different classes according to the results obtained. This avoids the mixing of heavily contaminated soil with less contaminated soil, and the most suitable ex-situ method for the level of contamination can be selected. Ex-situ remediation is often preferred over in-situ methods as it is an environmentally safer, cheaper and faster way to remove any contaminants from a site. This is especially the case in relation to construction projects where there is not enough time to wait for an in-situ remediation process to be completed.

Reuse of soil

Every year, a large quantity of clean as well as contaminated Danish soil is removed from its original location due to construction and/or remediation activities. There are no official estimates as to the annual amount; however, a survey conducted for the Danish EPA estimates that from 2007 to 2010, the three biggest soil treatment facilities in Denmark received more than 10 M tons of soil. Within the same period, the Danish Road Directorate reused around 18 M tons of soil in different projects. Lastly, more than two million tons of soil have been put directly to use in new construction projects, such as noise barriers along roads and motorways, coastal protection, land reclamation or landscape modelling.

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(RFH).
The RFH approach has recently been tested with promising results by the Capital Region of Denmark in collaboration with the private consultancy Orbicon A/S and the construction company Frisesdahl A/S among others. The preliminary test results showed that the method is well suited for small-scale in-situ remediation projects at sites which are difficult to access (e.g. remediation of soil under private homes).
Another example is the use of gas burners to heat up the soil. The Danish companies Arkil A/S, FORCE Technology, and Orbicon A/S have tested this method with promising results in collaboration with the Capital Region of Denmark.

In-situ biological remediation

A number of Danish companies excel in this type of remediation measure, which relies on microorganisms to break down the organic contaminants present in the soil. A decision tool for estimating the optimal stimulation process of naturally occurring bacteria in a given contaminated soil has recently been developed in a collaboration between the Danish Technological Institute, the University of Aalborg, and the private companies bioREM ApS and DGE Group. The tool can also be used to assess whether it is beneficial to use the bioaugmentation approach at a specific site and, if so, which bacteria are most suitable for the process. In-situ biological remediation has a number of advantages in comparison to other remediation techniques. First of all, it causes minimal disturbance to the environment at the contamination site, as the need to remove or replace soil is limited. This also makes in-situ bioremediation measures cheap in comparison to many other remediation measures, as there is no need to transport contaminated materials for ex-situ treatment. However, the method can only be deployed for some types of soil, and natural conditions which have an impact on the bioremediation process, such as temperature and weather conditions, are very difficult to control. In some cases, ex-situ bioremediation might therefore be a preferable alternative.

Purified soil reused for land reclamation

The Danish city of Køge is currently developing a completely new urban area by the sea. In order to make room for industry and housing, an area of more than 100,000 square metres is being reclaimed from the sea for urban development. The many tons of soil needed for such a project are brought from sites all over the country, and are remediated at the local Jordrens Køge ApS soil treatment facility situated on site. As the Danish standards and regulations for the reuse of soil are very strict, the purification level of the remediation process has to be exceptionally high. This is achieved using the BioBoxTM system developed by the Danish technology company Cleanfield Denmark ApS. The BioBox™ approach is a biological remediation process in which a bio-cocktail is used to decompose the contamination in the soil. The process of mixing the bio-cocktails for the system as well as monitoring the remediation process takes place in the BioBox™ itself, which is essentially a container. The BioBox™ is equipped with computers that enable smart monitoring and the remote control of the entire process. Another central aspect of the BioBox™ system is that it is able to constantly change the composition of the bio-cocktails used for the remediation process according to the conditions in each individual pile. This unique dynamic recipe system optimizes the decomposition process as it is based on real-time information collected from each pile 24/7.
www.cleanfield.com
http://www.cleanfield.com

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Applicable approaches for soil remedation

The 12 Principles of Green Chemistry (Anastas and Warner 1998)

1. *Prevention*: it is better to prevent waste than to treat or clean up waste after it has been created.
2. *Atom economy*: synthetic methods should be designed to maximize the incorporation of all materials used in the process into the final product.
3. *Less hazardous chemical syntheses*: wherever practicable, synthetic methods should be designed to use and generate substances that possess little or no toxicity to human health and the environment.
4. *Designing safer chemicals*: chemical products should be designed to affect their desired function while minimizing their toxicity.
5. *Safer solvents and auxiliaries*: the use of auxiliary substances (e.g. solvents, separation agents) should be made unnecessary wherever possible and innocuous when used.
6. *Design for energy efficiency*: energy requirements of chemical processes should be recognized for their environmental and economic impacts and should be minimized. if possible, synthetic methods should be conducted at ambient temperature and pressure.
7. *Use of renewable feedstocks*: a raw material or feedstock should be renewable rather than depleting whenever technically and economically practicable.
8. *Reduce derivatives*: unnecessary derivatisation (use of blocking groups, protection/de-protection, temporary modification of physical/chemical processes) should be minimized or avoided if possible, because such steps require additional reagents and can generate waste.
9. *Catalysis*: catalytic reagents (as selective as possible) are superior to stoichiometric reagents.
10. *Design for degradation*: chemical products should be designed so that at the end of their function they break down into innocuous degradation products and do not persist in the environment.
11. *Real-time analysis for pollution prevention*: analytical methodologies need to be further developed to allow for real-time, in-process monitoring and control prior to the formation of hazardous substances.
12. *Inherently safer chemistry for accident prevention*: substances and the form of a substance used in a chemical process should be chosen to minimize the potential for chemical accidents, including releases, explosions, and fires.

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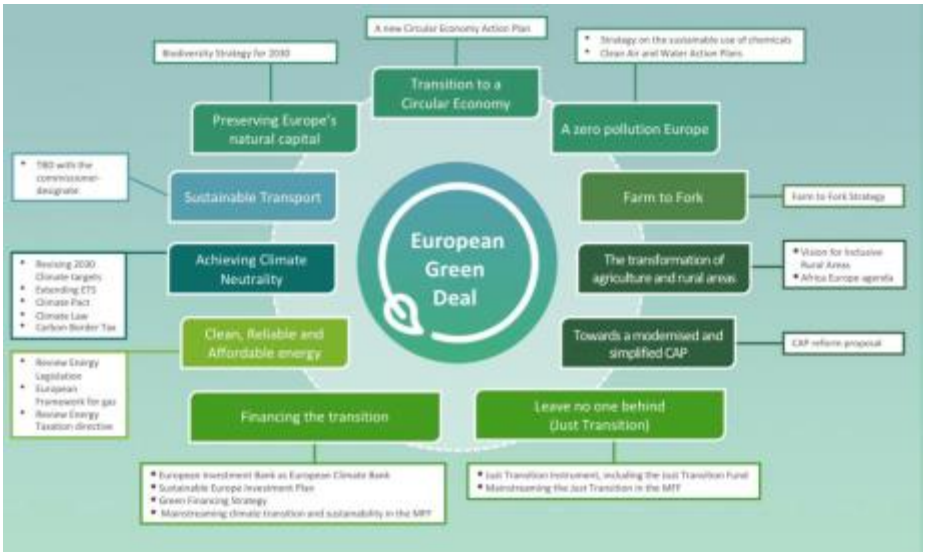
European Green Deal is a set of policy initiatives by the European Commission with the overarching aim of making Europe climate neutral in 2050



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